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THE ENGINEERING AND MINING JOURNAL.

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Siemens's Regenerative Furnace.

HAVING frequently had occasion to refer to this furnace, and never having given a description of it, we now make good our deficiency in this respect. The principle on which the furnace is constructed is so good, and it has already come into such general use in Europe, for operations requiring a high temperature, that all our readers should be familiar with it, especially as many of them are, doubtless, at the present moment carrying on works in which this furnace could be introduced with great advantage, both in saving fuel and in lightening the manual labor required.

In this country, it is in use for making cast steel, puddling iron, and manufacturing both plate and flint glass.

One of the principal advantages of this furnace is that it is very easy to keep the temperature under perfect control; to raise or lower it within very considerable limits with nearly the same ease with which we lower or turn up the gas in our houses.

An approach to the idea of making use of the superfluous heat, which passes ordinarily into the chimney, to warm the air and gas before they pass into the furnace, was made by ERICSSON, years ago, when he proposed passing the hot air from his caloric engine, after it had done its work, through a series of sheets of wire gauze, and afterwards to pass the fresh air through the same wire gauze before passing it into the furnace. ERICSSON imagined that in this way he could recover nearly all the heat which would otherwise be lost, not knowing that, according to the mechanical theory, a certain amount of the heat had already been converted into its equivalent motion.

The SIEMANS's furnace consists of three distinct parts: The generator or gas producer, the regenerator, and the furnace, either reverberatory or muffle, in which the heat is used.

The gas producer is a shaft with the front wall inclined from the top to the bottom, from the front to rear. The upper portion of this incline is formed of iron plates covered with fire-bricks, and the lower portion is an open grate, formed of horizontal steps—a large opening under the lowest being for convenience of drawing out clinkers, which generally collect at that point. The fuel is supplied at intervals of from two to four hours, through charging-boxes on the top, and descends gradually on the inclined plane, which is set at a proper angle to suit the fuel used. Small stoppered holes at the front and top of the producer are provided to allow of putting in an iron bar occasionally to break up the mass of fuel and detach clinkers from the side walls. Each producer is capable of converting daily about two tons of fuel into a combustible gas, which passes off through the uptake leading to the furnaces.

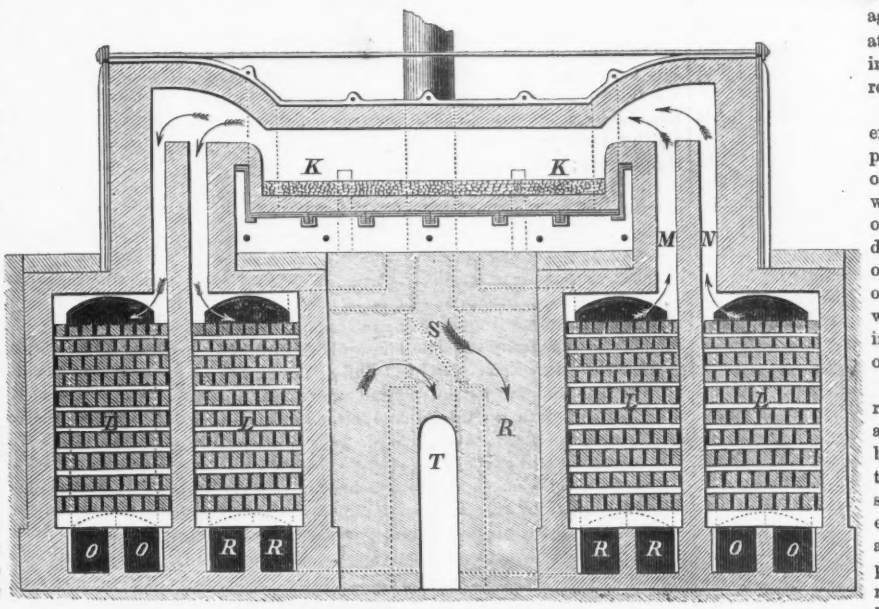
The action of the gas producer in working is as follows: The fuel descending slowly on the solid portion of the inclined plane, becomes heated, and parts with its volatile constituents, the hydro-carbon gases, water, ammonia, and some carbonic acid, which are the same as would be evolved from it in a gas retort. There now remains from sixty to seventy per cent. of purely carbonaceous matter to be disposed of, which is accomplished by the current of air slowly entering through the grate, producing regular combustion immediately upon the grate; but the carbonic acid (a non-combustible gas) thereby produced, in passing slowly on through a layer of incandescent fuel from two to three feet thick, takes up another equivalent of carbon, and is thus transformed into carbonic oxide, (an inflammable gas), which passes off with the other combustible gases to the furnace. For every cubic foot of combustible carbonic oxide thus produced, taking the atmosphere to consist of one-fifth part by volume of oxygen and four-fifths of nitrogen, two cubic feet of incombustible nitrogen pass also through the grate, tending greatly to diminish the richness or heating power of the gas. Not all the carbonaceous portion of the fuel is, however, votalised on such disadvantageous terms; for water is brought to the foot of the grate by a pipe, which, absorbing the spare heat from the fire, is converted into steam; and each cubic foot of steam, in traversing the layer of from two to three feet of incandescent fuel is decomposed into a mixture consisting of one cubic foot of hydrogen and nearly an equal volume of carbonic oxide, with a variable small proportion of carbonic acid. Thus one cubic foot of steam yields as much inflammable gas as five cubic feet of atmospheric air; but the one operation is dependent upon the other, inasmuch as the passage of air through the fire is attended with the generation of heat, whereas the production of the water gases, as well as the evolution of the hydro-carbons, is carried on at the expense of heat. The generation of steam from the water being dependent on the amount of heat in the fire, regulates itself naturally to the requirements; and the total production of combustible gases varies with the admission of air. And since the admission of air into the grate depends in its turn upon the withdrawal of the gases evolved in the producer, the production of the gases is regulated by the demand for them. The production of gas may even be arrested entirely for twelve hours without deranging the producer, which will begin work again as soon as the gas-valve of the furnace is re-opened; since the mass of fuel and brick-work retain sufficient heat to keep up a dull red heat in the producer during that interval. The gas is, however, of a more uniform quality when there is a continuous demand for it, and for this reason it is best to supply several furnaces from a nest of gas producers, so as to keep them constantly at work. A damper can be inserted in the uptake, so as to shut off any gas producer at pleasure.

It is important that the main gas-flue leading to the furnaces should contain an excess of pressure, however slight, above the atmosphere, in order to prevent any inward draught of air through crevices, which would produce a partial combustion of the gas, and diminish its heating power in the furnace, besides causing a deposit of soot in the flues. It is, therefore, necessary to deliver the gas into the furnace without depending upon a chimney draught for that purpose. This can easily be accomplished when the gas producers are placed at a lower level than the furnaces; but as that is not always practicable, the following plan has been adopted: The mixture of gases on leaving the producers has a temperature ranging between 300° and 400° Fahrenheit, which must, under all circumstances, be sacrificed, since it makes no difference to the result at what temperature the gas to be heated enters the regenerators, the final temperature being in all cases very nearly that of the heated chamber of the furnace, or say, 2,500° Fahrenheit. The initial heat of the gas is, therefore, made available for producing a plenum of pressure by making the gas rise about twenty feet above the producers, then carrying it horizontally through a wrought-iron tube, and letting it again descend to the furnace. The horizontal tube being exposed to the atmosphere, causes the gas to lose from 100° Fahrenheit to 150° Fahrenheit of temperature, which increases its density from 15 to 20 per cent., and gives a preponderating weight to that extent to the descending column, urging it forward to the furnace.

A diagram of a regenerative gas furnace is shown in the accompanying figure. Underneath the heating chamber, K, are placed four regenerative chambers, L, which are filled with fire-bricks, built up with spaces between them. The regenerative chambers work in pairs, the two under the left-hand end of the furnace communicating with that end of the heating chamber, while the other two communicate with the opposite end. The gas enters the heating chamber through the passage, M, and the air through the passage N, whereby they are kept separate up to the moment of entering the heating chamber, but are then immediately to mingle intimately, producing at once an intense and uniform flame.

From the air-flue, the entering air is directed by the reversing valve, S, into the air regenerator, and there becomes heated ready for entering the furnace; at the same time, the gas entering from the gas-flue is directed by a reversing-valve into the gas regenerator, where it also becomes heated to the same temperature as the air.

The products of combustion, on leaving the opposite end of the furnace, pass down through the second pair of regenerators, (as shown by the arrows), and after being there deprived of their heat, are directed by reversing-valves into the chimney-flue. When the second pair of regenerators have become considerably heated by the passage of the hot products of combustion, and the first pair correspondingly cooled by the entering gas and air, the valves are reversed by a hand-lever, causing the currents to pass through the regenerators in the contrary direction, whereby the hot pair of regenerators are now made use of for heating the gas and air entering the furnace, while the cool pair abstract the heat from the products of combustion escaping from the furnace. The supply of gas and air to the furnace is regulated by the adjustable stop-valves, S, whereby the nature and volume of the flame in the furnace may be varied at pleasure, whilst a chimney damper, T, is used to regulate the amount of pressure in the furnace in relation to the atmosphere, so as to allow the opening of the doors or working-holes of the furnace. Messrs. TUTTLE, GARFIELD & Co., Boston, Mass., are the American agents. The royalties charged are moderate, and are calculated upon the actual saving effected, as exhibited by furnaces already at work.



SIEMENS'S REGENERATOR.

The regenerative gas furnaces are now extensively employed for all metallurgical purposes, with an economy in the weight of fuel generally amounting to 50 per cent., which may be further enhanced by the use of inferior qualities, such as slack, coke-dust, lignite, and peat. There are also other advantages attending the application of these furnaces, such as a saving in the waste of iron in heating and puddling, and in all cases an improvement in the quality of the produce.

Since the end of the year 1865, several regenerative gas furnaces have been erected and put to work for melting steel in crucibles, and the results have been a consumption of one and a quarter tons of common slack to the ton of ordinary tool steel melted, as compared with a consumption of about three tons of hard coke for the same purpose in an ordinary furnace, being a money saving of upwards of 80 per cent., besides a great saving in pots, and in the repairs of the furnace. Among the pleasing features of this furnace are the continually-increasing demand, both in this country and abroad, and the universal satisfaction expressed by those who have tried them.

Iron and Steel.

THE invention of Mr. CHARLES W. SIEMENS consists of an improved mode of introducing the reduced ore into the open hearth of the melting furnace without, on the one hand, exposing the reduced ore to the oxidizing action of the flame, and, on the other hand, without exposing the reducing hoppers, retorts, or muffles to the extreme heat of the smelting furnace. For this purpose the inventor does not discharge the reduced ore directly into the melting furnace, as heretofore, but into a chamber or chambers arranged at the back or along the sides of the same, in which chamber or chambers a reducing atmosphere is maintained by an influx of reduction gases, although there exists an open communication between the chamber and the furnace. The bottom surface of the chamber inclines towards the hearth of the melting furnace upon which the metallic bath is prepared, in order to facilitate the introduction of the reduced ore into the bath, when required, by means of rabbles introduced through a door or doors opposite the melting chamber. From this reduced ore chamber or chambers vertical or inclined hoppers or retorts rise upwards, into which the raw or calcined ore, together with the reducing and fluxing materials, are charged from above, by preference in a heated condition, and around these hoppers or retorts channels are provided, through which flame is made to circulate.—*London Mining Journal.*

Martin-Henry Rifles.

THE Portuguese Government are asking for a supply of 10,000 rifles on the Martin-Henry principle, and 1,000,000 cartridges; also for 14,000 butt ends for Enfield rifles, and 1,000,000 cartridges for the Snider arm.

Hot-Air Engines.

From the Report of Dr. F. A. P. BARNARD, U. S. Commissioner to the Paris Exposition.

Of engines driven by heated air, several varieties were exhibited at the Exposition. All of these have certain advantages in common, and all are subject to certain disadvantages which are inseparable from the system. It is an advantage that they require no boiler, and are exempt from the dangers which arise from that source. Could air be employed at a pressure equal to that of steam, it would be an important advantage to be free from the great weight which the use of the boiler necessitates, and unembarrassed by its bulk. As yet, however, this condition has not been realized, and hence the dimensions of the working parts of air-engines are necessarily so much more considerable than those of steam-engines of corresponding power, as to render the gain in this direction, if there is any, unimportant. It is, however, an advantage that air-engines are cheaper of construction than those driven by steam, and that their management is easier, and requires less constant watchfulness. It has generally been claimed for them that they economize fuel. Theory might seem to justify this claim, but in practice it has hardly been sustained.

The disadvantages of air-engines consist in the difficulty of heating and cooling the air employed with the rapidity necessary to secure the best performance; and in the fact that the supply of the cylinder consumes more than half the power developed. To this it may be added, that, while the efficiency of the machine depends upon the difference between the maximum and minimum temperatures, there are certain practical limits which neither of these temperatures can transcend.

Air-engines may be arranged in two classes, of which the first embraces those which draw their supplies directly from the atmosphere, and discharge them into the atmosphere again after they have produced their effect; and the second, those which employ continually the same air, which is alternately heated and cooled, but is not allowed to escape. The Ericsson engine which has been established among us for many years, and which, for minor industries, is in so great esteem, is an example of the first class. The engine of Mr. LAUBERAU, which will presently be described, illustrates the second.

In each of these classes a subordinate classification may be made, according as the air is heated in the cylinder in which it performs its work, or in a separate chamber. The plan of the Ericsson engine is the first of these. That of Mr. SHAW'S invention exhibited in the American section, and also of Mr. ROPER'S in the same section, the second. Of machines which do not discharge the air, Mr. LAUBERAU'S was the only one exhibited. In this, the work is done in one cylinder, and the heat is applied in another. This class of machines admits of several modifications of arrangement, all of which have been employed by different inventors with more or less success. The heater and the refrigerators, for example, may be both independent of the working cylinder, and of each other; presenting an analogy to the boiler and condenser of the steam-engine; or the refrigerator only may be separate; or, finally, as in the engine of Mr. LAUBERAU, the heating and refrigeration may take place at the opposite extremities of the same vessel, the air being driven from one end to the other alternately by means of a plunger.

Certain propositions are true of all these machines. In the first place, there is a theoretic limit to the economy of which they are capable—that is to say, of the heat which the air receives from the source, a fraction only can, under any circumstance, be converted into mechanical force; and theory enables us to state the maximum value which this fraction can have. This maximum depends only on the extreme temperatures at the command of the engineer; and is therefore the same for all hot-air engines, and not only for these but for all engines whatever driven by heat, whether the elastic medium employed be air or steam, or ammonical gas, or the vapor of ether or of any other volatile liquid. But in no engine yet constructed has this economical limit been reached, or even very nearly approached.

As the proposition here stated is a very important one, it is proper to devote a few words to its illustration. Its truth is directly demonstrable from the principles of the mechanical theory of heat. In fact, when the elastic force of air or steam is employed as a motive power, the maximum limit of possible advantage, and therefore of economy, is easily ascertained, by following the successive changes, in regard to volume and temperature, through which a limited portion of the elastic medium (a single charge, for instance, of the working cylinder) must pass, in order that it may produce the largest elementary portion of work of which it is capable, and be restored to its original condition, or to the state in which it may be available to produce a second useful effect. In practice this cycle is not usually completed; and the same portion of the elastic medium is not made repeatedly serviceable. At a certain point of its expansion, the steam or the heated air is discharged into the atmosphere, while a fresh portion is taken up to supply the place of that which is thus abandoned. When, in the case of steam, a condenser is used, the water produced by condensation is returned to the boiler; but here the regularity of the cycle is broken by the abrupt condensation of the steam before it has performed all the work of which it is capable. On this account no steam-engine fulfils the conditions of largest economy. But the fraction of work which is voluntarily sacrificed could usually be saved only at the expense of a more than compensating inconvenience. In the case of steam, the cycle of changes which takes place in the production of the largest possible amount of available force of which a given volume of the medium is capable, consistently with the supposition that it is finally restored to its original state, so as to permit a repetition of the effect, is the following:

I. The large expansion attendant on the conversion of water into steam with the volume due to the temperature and pressure of the boiler.

II. The dilatation of this steam with diminishing pressure and temperature, until its elastic force is in equilibrium with that of the surrounding media—of the atmosphere, in the case of a non-condensing engine, and of the vapor in the condenser, in a condensing engine.

III. The reduction of the volume of this steam, or mixed steam and water, without elevation of temperature (that is, with a constant abstraction of the heat produced by the compression) to such a bulk that,

IV. A final compression, without abstraction of heat, shall restore it to the boiler in the form of water under the original temperature and pressure. In the third step of this progress, the force required for the compression is constant, and is simply that which is necessary to clear the cylinder against the resistance of the atmosphere or of the vapor in the condenser; but it is attended with progressive condensation of the vapor still remaining to the form of water; the latent heat thus developed being supposed to be removed by suitable means of refrigeration. In the final compression it is the force of increasing pressure which completes the condensasion; and the developed latent heat brings up the temperature of the water to that of the boiler. In this series of changes, the expansion in the first term and the compression in the third are attended with no change of elastic force, since the temperatures remain constant, and the densities also; vaporization, on the one hand, and condensation on the other, compensating for change of volume. In the first stage heat is constantly received from the fire; and in the third it is constantly abandoned to the refrigerator. In the second and fourth no heat is either received or given up. There is constant loss in every stage by the effect of radiation and conduction; but this, in the abstract theory, is not considered, and in practice is guarded against as far as possible.

When the medium employed is air, or a permanent gas, the cycle of changes is similar, but the pressures are variable throughout. In the first and third stages the temperatures are constant, as in the case of steam. In the second the temperature falls, and in the fourth it rises. During the first stage heat is received from the fire in such quantities as to prevent any depression of temperature in consequence of the expansion, but not enough to produce any elevation of temperature. This heat is entirely converted into work, and is the exact equivalent of the work done in this part of the cycle. During the second no heat is received or given up; but the temperature falls, and the work done is the equivalent of the heat which thus seems to disappear. In the third the volume is reduced by compression, and a refrigerator absorbs the heat which the compression develops, so as to maintain a constant temperature; and in the fourth further compression elevates the temperature to that with which the cycle commenced, while at the same time it restores the original bulk. In this change the temperature rises through as many degrees as it fell during the second period; and the same amount of heat which then seemed to disappear now makes its reappearance. The work done with positive effect in one of these two stages balances that which is expended unprofitably in the other; so that the amount which is finally available for use is the difference between the work which is performed during the expansion in the first stage and that which is consumed in the compression which takes place in the third. And this, as we have seen, is measured by the heat received from the fire, diminished by the heat imparted to the refrigerator. * * * * *

Now the heat consumed in expanding an elastic fluid through a space bearing a definite proportion to its bulk without change of temperature (which is the measure of the work done at the same time), must of course be proportional to the pressure; and this is itself proportional to the temperature measured from the absolute zero, two hundred and seventy-three degrees below the zero of the Centigrade thermometer. And the heat developed in compressing a similar fluid through a similar space must, for the same reason, be proportionate also to its temperature. The actual bulk of the air during the expansion in the first stage of the cycle above described, and during the compression in the third stage, is not the same; but the ratios of the bulks at the beginning and end of the expansion, and at the beginning and end of the compression, are equal, and accordingly the quantities of heat received in the first instance from the fire, and imparted in the second to the refrigerator, are proportioned to the temperatures at which the expansion and compression take place. It hence appears that, of the heat required to operate an air-engine which fulfils the conditions above described, the proportion which is convertible into useful work will be greater or less, according as the maximum and minimum temperature differ more widely. And what may be called the coefficient of economy for such an engine may be thus expressed:

If T be taken to represent the superior temperature measured from the absolute zero, and T′ the inferior; and also Q to represent the quantity of heat received from the fire during the first expansion, and Q′ the quantity transferred to the refrigerator during the first compression; and finally, if A represent a constant quantity dependent on the absolute pressure and bulk of the gas at a given temperature, then we shall have, $Q=AT$; $Q'=AT'$; $Q-Q'=A(T-T')$.

As $Q-Q'$ is the portion of the heat utilized, and Q the entire amount received from the fire, the economical coefficient, or the fraction showing the ratio to the whole of the part which is made usefully available, and which may be represented by U, will be,

$$U=\frac{Q-Q'}{Q}=\frac{A(T-T')}{AT}=\frac{T-T'}{T}$$

It follows that, in proportion as the interval between T and T′ is increased, the machine will work with correspondingly greater economy. This interval can be increased by increasing T, or diminishing T′, or by doing both at once. It is impracticable, however, to employ a refrigerator having a temperature below that of the weather. We must therefore take for a mean lower limit about 17° C, or 62° 6 F, a temperature which, referred to the absolute zero, is equal to 290° C. On the other hand, a practical upper limit is imposed by the consideration that a red heat is reached for solids at about 650° C, which is 923° C above the absolute zero. This limit could not be safely approached; but supposing it to be actually attained, the economical coefficient would be

$$\frac{923-290}{923}=0.684$$

or a little more than two-thirds of the heat taken up by the air. Probably no hot-air engine has yet been actually employed, in which the temperature has been carried much above 300° C. With a maximum temperature of 307° C = 580° C above the absolute zero, the economical coefficient would be

$$\frac{580-290}{580}=0.50$$

which would show a utilization of one-half the heat taken up. The first Ericsson engine was designed to work at a maximum temperature of about 450° F = 232° C = 505° above the absolute zero. The limit of economy realizable by it, had it been successful, and provided the air could have been made to pass through the complete cycle of changes embraced in the theory, would have been

$$\frac{505-290}{505}=0.426.$$

But in point of fact, no hot-air engine fulfils, or can fulfil completely, the theoretic conditions. In order to do so, it would be necessary that the air should leave the working cylinder at the minimum temperature; that is to say, at a temperature as low as that of the supply; or else that, by some contrivance, the excess of heat which it retains should be transferred to the supply on its way to the working cylinder. As the first of these conditions—that is to say, the expansion of the air in working sufficiently to reduce the temperature to the minimum—is practically unrealizable, it is the second which inventors have in many instances sought to secure. In order to accomplish this, the emergent air has in some cases, as in ERICSSON'S original engine, been made to pass through successive sheets of wire gauze, or between thin sheets of metal, or has been in some other manner brought into contact with metallic surfaces of large extent in proportion to the weight of the mass, in order that the excess of heat being transferred to these might be afterwards taken up by the cold air of the supply as it enters. The first of the expedients here mentioned was employed by Mr. ERICSSON, and the second in the earlier invention of STERLING. In SHAW'S engine, exhibited in the Exposition, the hot air escapes through a cluster of thin tubes, while the cold air circulates between them. The term "regenerator" was applied by Mr. ERICSSON to this contrivance as applied to his original engine, and this term has come into general use. The regenerator is applicable to any form of engine, but it is not employed in all. The theoretic advantage is considerable, but in practice is not fully realized; and it is attended with the disadvantage of sensibly increasing the amount of the passive resistances of the machine. In fact, in order that the regenerator, suppose it for instance to be a succession of wire gauze sheets, should entirely absorb the excess of heat of the escaping air, the number of sheets should be very considerable. It is easily seen that if this number were quite unlimited, there would be somewhere a point at which the air would have no longer any heat to impart; its temperature being sensibly reduced to that of the metal. From this point backward to the cylinder from which it was discharged, the successive sheets of wire gauze would rise in temperature, and the last one would have sensibly the same temperature as that with which the air emerged. The number of sheets which would be required effectually to absorb the heat, would depend, for a given excess of temperature, upon the closeness of the meshes, and in any case must be considerable. The obstruction which every such contrivance necessarily presents to the free passage of the air, creates a resistance which makes its presence objectionable, and which may go far to neutralize the advantage which it is designed to secure. By diminishing the number of the sheets and the closeness of the meshes, the resistance is reduced, but the absorption of the heat is proportionally less complete. Practically, where the regenerator continues to be used, a middle course is taken; the economy is not wholly realized, and the obstruction to circulation is not very serious. This is the case in the engine of Mr. SHAW, in which the regenerator consists, as above remarked, of a series of tubes. It is to be considered, however, that the loss of heat suffered in operating engines driven by heated air or steam, is by no means limited to the fraction, large as it is, of the heat which, after being actually imparted to the medium, is unavailable for work. If this were true, the cost of working such engines would fall to a very small proportion of what it actually is. It is, unfortunately, the case that by far the largest source of loss is to be found in the escape of a large part of the heat which the combustible develops in other ways than in raising the temperature of the elastic medium which does the work. And the improvement of all these engines, so far as economy is concerned, is to be sought in such forms of furnace, and such modes of applying heat, as may reduce what is now the sheer waste of the chimneys or of the radiating surfaces, rather than in the endeavor to push to extremes the temperature employed in the working cylinder.

It is to be observed that the difficulty of guarding against losses by conduction and radiation is enormously increased

when excessive temperatures are employed; and also that such temperatures decompose lubricants, destroy packing, and, by the large expansion which they give to metals, loosen joints and impair the strength of the whole structure. Since the largest room for economy is evidently in the direction of preventing the wholly useless waste at present occurring, the effort should be to keep the maximum temperature as low, and not to push it as high, as possible.

ERICSSON'S ENGINE.

The engine of Mr. ERICSSON is too generally known to need many words. In its present form it differs essentially from that which it had when constructed on a large scale, some fifteen years ago, to be employed as the motive power of a seagoing vessel; or, more properly, the present one is a different machine. In the original model a working cylinder was placed immediately over the fire of the furnace, and a cylinder of supply of about two-thirds the capacity was placed immediately over that. The engine was single-acting, the working cylinders were quite open, and the working pistons were of great bulk, and formed of non-conducting substances, being designed to fill the cylinders when at the point of the lowest depression, so as to prevent their cooling by contact with the air of the atmosphere. The bottom of each cylinder was arched, forming a dome for a furnace; and the piston received, at its lower surface, a corresponding figure. The pistons of the supply cylinder and working cylinder were firmly connected, and had therefore an equal length of stroke. At the descent of the piston the supply cylinder was filled by aspiration from the atmosphere; and in the ascent the charge, after undergoing compression, was driven into a reservoir, from which it passed subsequently into the working cylinder. The upward stroke being completed, the heated air escaped through a regenerator formed of wire gauze, depositing there its excess of heat; and the new charge from the reservoir, passing to the working cylinder through the same regenerator, re-absorbed this heat, and thus entered the heating chamber already at an elevated temperature.

This engine, it will be seen, was remarkably simple in construction. It also performed very well in practice, so far as its performance was merely a question of mechanics. But it failed, because the heating arrangements were inadequate to the demand made upon them. Mr. ERICSSON did not expect to be dependent on his furnaces for the supply of more than a moderate fraction of the heat which each successive charge of air was to receive. It was his anticipation that the regenerators would serve to transfer so large a quantity from each charge to the next, that it would be necessary to provide for little more than the always inevitable loss by mere radiation. This anticipation was not realized, and in fact could not be, since no account was taken of the large amount of heat necessarily transformed into work. But there was a cause of failure superadded to this, arising from the difficulty of heating air at all by means of a furnace. Radiant heat produces scarcely any impression upon a body of air through which it passes. The inventors of all the air engines which have been to any degree successful have recognized the necessity of applying their heat as much as possible by conduction and actual contact. Mr. ERICSSON himself is no exception, as his engine presented in the Exposition shows. This machine possesses a special interest, from the fact that it was the first of its class to secure for itself a recognized place in the industrial world as a valuable aid to productive power.

In its present form the ERICSSON engine fails to present to the observer a combination at first view easily intelligible. It even seems to be characterized by a certain amount of complication, which might suggest greater liability to derangement than ought to belong to a prime mover. A closer examination, nevertheless, will show that the mechanism itself is in fact very simple, and that it is only the rather puzzling consecution of movements which confuses.

Without referring to the figure of this engine, which is given in the report, the following general explanation of the mechanical principles of its construction will be understood: Let it be supposed that a piston moves air-tight in a cylinder which is closed at both ends. Call one end of the cylinder A, and the other B. Call the piston also C. In the end A let there be a valve opening inward, and in the end B a second valve opening outward. These two valves open, then, in absolute direction, the same way. Let the piston C, furthermore, have a valve opening in this common direction. Then, if the piston C move toward B, its own valve will naturally close, and that of B will open, because the movement tends to compress the air between B and C. Also the valve A will open at the same time, because the movement tends to rarify the air between A and B. Thus, in this movement, continued to the end of the cylinder, all the air on the side toward B may be expelled; but at the same time the cylinder will be filled on the other side toward A, by the influx of air from without. If the piston C now reverse its motion, both the valves A and B will be closed, because the movement will tend to rarify the air on the side of B, and to condense it on the side of A. But its valve will be opened by the joint effect of these causes, so that the air will pass freely through the piston; and if the motion continues, will ultimately be all transferred to the side of B. This operation may go on indefinitely.

Now, if on the side of A, the cylinder is closed by a second piston (which we may still call A,) and not by a fixed cap, both pistons being movable, the same succession of occurrences will take place, only modified by the movements which may be given to A. If C and A both move in the direction of A, both their valves will open, and air from the exterior of the cylinder will pass through both into the space between B and C. If they both move toward B, but C faster than A, then air will enter on the side of A, and flow out on the side of B, the valve C only remaining closed. If both move toward A, but A faster than C, air will still enter the space between C and A, while, in less quantity, it is passing through C into the space between C and B.

Let now the piston A be supposed to occupy a position, say one-third advanced down the cylinder, the piston C being further advanced still, and let the valve of B be secured by a strong spring pressing upon it, so that it cannot be opened without the application of some considerable force; and in these circumstances let the cylinder, and consequently the air contained in it, be heated. The elasticity of the confined air being increased by heat, will close the valve in A, and that piston will be moved in the direction of A, until, by the enlargement of volume, the elasticity shall be reduced to equality with that of the external air. If the heat be uniform throughout all the mass of confined air, the valve in C will be equally pressed on both sides. Under these circumstances the piston C. could be moved toward A, if there were any means of acting upon it, the air passing through the valve toward B. But if an attempt were made to move the piston itself toward B, it would encounter resistance, because its own valve would be closed by the movement, and the valve of B is supposed to be forcibly held down. Since now the external piston must move in the direction A, it is only necessary that it should be properly connected with a machine, in order that the force exerted by the heated and expanding air may be turned to some practical account.

If, again, at the end of the movement, the air could be immediately cooled without being discharged, the heat could be again applied and the effort repeated. But this not being practicable, the heated air may be allowed to escape by relieving the valve B of the pressure of the spring which confines it, and by causing the piston C to descend to the extremity B of the cylinder. This movement of C not only drives out the hot air, but it draws in through A a fresh supply of cold air; and if A descends simultaneously to the position originally supposed, *i. e.*, one-third advanced toward B, there will be a body of air filling the other two-thirds of the cylinder at the common temperature, ready to be acted on anew by heat.

In this statement is embraced the general principle of the Ericsson engine. What remains is to explain the mechanical contrivances by which the movements of the pistons are governed, and to describe the heating apparatus which is employed to effect the prompt dilatation of the air. Inasmuch as the piston which we have called C is shut up in the cylinder behind A, it is necessary that the rods which give it motion should pass through A. They do so, being packed by means of stuffing boxes to prevent leakage, and are connected at their external extremities with oscillating levers turning on a fixed centre of motion at their extremities, and kept in motion by the engine. The rod of the external piston, A, which is the driving piston, is also connected with an upright oscillating lever, turning on an axis of motion at its lower extremity, and carrying at its upper a horizontal connecting rod, which acts on the crank of the main shaft of the engine. It would be simpler to connect the piston directly with this crank; but if that mode of connection were adopted, the stroke of the piston would have to take place in both directions, forward and back, in equal times. This condition is not favorable to the action of the machine; and inequality in this respect is still more important in the case of the supply piston. The peculiar ingenuity of this machine is, in fact, manifested most signally at this point. By means of the systems of levers interposed between the pistons and the main shaft, provision is made for the perfect uniformity of the revolution of the shaft, while the pistons, on the other hand, are accelerated and retarded in such a manner as to fulfil the condition that the aspiration of the charge of air should occupy the minimum of time. The oscillating levers which connect with the piston-rods of the supply piston are kept in oscillation by crank motion from the main shaft, and in their oscillations they displace the inner piston, encountering no resistance but friction. In consequence of the un-uniform and unequal velocities of the two pistons, and their intentional adjustment so that they do not begin and end their course together, the distance between them varies in a manner which is quite important, first to the aspiration of the charge, and secondly to the effectual exposure of the aspired air to the action of the furnace.

It is of course of the highest importance that the positions of the cranks on the main shaft, and those of the axes of motion of the oscillating levers, should be so related to each other as to produce a rapid separation of the two pistons at the beginning of the negative stroke; because this is the time when the aspiration of the charge must take place. During this time the inner piston, gaining on the outer, will not only draw in the fresh charge, but it will expel the exhausted one; the escape valve being lifted for the purpose, and kept raised during all the period of aspiration by means of a cam. When the pistons are at the maximum distance from each other the aspiration is ended. From this time until the half revolution is complete the confined air undergoes compression, and the movement is maintained by the fly-wheel. In the second half revolution the driving piston is urged by the elasticity of the air, which is exalted both by compression and by heat.

The heating is accomplished as follows: The furnace is within the cylinder, at the end which we have called B, where the cylinder is prolonged to receive it. It is of iron and is cylindrical also, a small annular space only intervening between its walls and those of the cylinder. This space is open to the interior, but is closed at the extreme end; so that it forms, in fact, a portion of the proper air chamber. To the supply piston C is attached by its crown a sheet-iron cylindrical bell, which enters the annular space just spoken of without touching the walls of the furnace or those of the surrounding cylinder. The valve in C opens above the crown of this bell; but any air which comes through the valve from the side of A can only reach the interior by passing down the annular space between the bell and the wall of the furnace. In making this passage it will be exposed in a very thin sheet to the action of the furnace heat, a very large proportion of the molecules being brought into direct contact with the heated iron.

That we may understand how this movement of the air is made forcibly necessary, we need only consider the relative movements of the pistons during the period of a complete revolution. At the beginning of the negative stroke, or of the movement of A in the direction of B, the supply piston takes the lead, air enters through the valve of A, and the aspiration is soon complete. The distance between the two pistons, which determines the amount of aspiration, is now of course at its maximum. A next begins to gain on C, but both movements have still for a short time the same (negative) direction. The space occupied by the air is gradually reduced; or, in other words, the air undergoes compression. The piston C reaches the limit of its course sooner than A. It begins to move in the positive direction, while the motion of A is still negative. The valve in C is opened by the pressure, the air passes through and, having no other channel, descends the annular space outside of the bell and returns by the annular space inside the bell, becoming heated, as above described, in its progress. Presently after this displacement commences, the piston A also reaches its limit of movement, and the direction of its motion becomes positive. But C moves the faster of the two, so that the displacement continues throughout the greater part of the positive stroke. A little before the end, the distance betwen the two pistons becomes minimum, and they are then nearly in contact. When the revolution is quite complete this distance is slightly increased. Just before this time C will have re-commenced its negative movement, while A continues still to be moving in the positive direction.

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Inasmuch as the effective power of this engine is negative or zero from 344° onward to 170°, or through a little more than half a revolution, it is necessary that the machine should be provided with a heavy fly-wheel to maintain the movement during these intervals. The fly-wheel is made to act also as a sort of counterweight, as well as by means of its moment of rotation, the side of the wheel which is descending during the period of paralysis being made considerably heavier than the other. A companion engine, to act positively during the inaction of the first, would render such an expedient unnecessary; but, unfortunately, the bulk is considerable relatively to the power, and it would, in general, be a disadvantage to double it.

The engines of Mr. ERICSSON are largely in use in the United States; but as yet they have not been constructed of any considerable power. As a general rule they fall within three or four-horse power, as an outer limit; though it is believed that there have been made some exceeding this limit. On account of their safety and convenience they have been regarded with favor; and it has been claimed for them, as an additional recommendation, that they are economical. Such did not appear to be the fact in the case of the particular engine which was the subject of the experiments of Mr. TRESCA above referred to. In this machine, which was of two-horse power, the result of very careful trial showed a consumption of 4.13 kilograms (about nine pounds) of coal per horse power per hour. In comparison with steam this cannot be called a large economy. The consumption of a good steam engine ought not to exceed, per horse power per hour, two kilograms at the outside. One and a half ought to suffice.

It may be observed, in conclusion, that Mr. ERICSSON makes no attempt to carry the temperature in this engine to a very high point. The mean maximum temperature in the experiments at the *Conservatoire* did not exceed 270° Fahrenheit, though doubtless portions of the air received a greater degree of heat than this. The expansion of volume was further determined to be but 1 : 1.48—that is to say, about fifty per cent. of the original bulk.

Theoretical Loss of Heat in a Blast-Furnace.

AN interesting article upon this subject is published in the *Bulletin of the American Iron and Steel Association*, an abstract of which follows:

Ironmasters are apt to credit many items of knowledge in reference to the working of blast-furnaces to practical experience, while they were really in the first instance worked up and demonstrated by scientific men. Iron men often have for this reason a disregard for the achievements of science in their profession, when they in reality owe to science most points of practical value.

There are so many items concerning the subject of iron-smelting which are to this day imperfectly understood by the best-informed men, that even a comparatively minute ray of light thrown upon the matter, or any little point explained, ought to be very favorably regarded not only for its own sake, but also for the discoveries to which it may lead.

An investigation of the action in a blast-furnace is dependent upon a number of other collateral investigations; such, for instance, as the determination of the amount of heat rendered latent during the liquefaction of the iron and slags; of the heat absorbed during the decomposition of the peroxide of iron, and of the limestone; of the losses of heat by radiation, and other kindred matters.

It was demonstrated long ago by LAPLACE and POISSON that if a gas is heated under pressure to any given degree, a certain portion of the heat is rendered latent by the expansion. The application of this principle to the blast-furnace we now propose to illustrate. Taking it for granted that the pressure at the mouth of a furnace is equal to that of the atmosphere, which is sufficiently correct for practical purposes, and supposing that a furnace consumes 26 cwt. of coke, and 6½ tons of air, heated to 1,000° Fah., and with one and a quarter at-

mospheres pressure to the ton of iron produced, the mere expansion of the blast would cause a diminution of the sensible heat by 1,000—909.5 = 90.5.

The latent heat of air, when maintained at a uniform pressure, being 0.238, the heat rendered latent in the manner just mentioned amounts, in the case we are considering, to 6.5×2,240×90.50.2×38, equal to 313,608 pound-degrees or thermal units. Each pound of carbon consumed in a blast-furnace may be taken as producing on an average 6,000 thermal units, hence the quantity of heat rendered latent by expansion is 313,608, divided by 6,000, or 52.26 pounds of carbon. This quantity, although it forms but a small proportion of the total loss by radiation, etc., is worth taking into account, when an estimate is made of the disposal of heat in the furnace. Larger furnaces, supplied with blast at higher temperatures and pressures will of course increase the loss from this cause.

MINING SUMMARY.

New Mexico.

THE BURRO MOUNTAINS — CHARACTER OF THE COUNTRY — EXTENT OF THE DEPOSITS — CHARACTER OF THE ORE, ETC.

A correspondent of the San Francisco *Bulletin*, writing from Ralston City, May 22, gives the following very interesting account of these new mines. It is more complete than any before published that we have seen, and conveys much valuable information that less competent writers have overlooked. He says:—"As these mines have attained celebrity, and are destined to be more widely and favorably known, their location should be described with approximate accuracy—all that any man can do at present. New Mexico claims them, and while Arizona does not deny it, she does not admit it. The line between New Mexico and Arizona is established on the 109th meridian of longitude west of Greenwich, and no line has ever been run or observations taken on it, not even at its intersection with the international boundary between Mexico and the United States, hence any positive opinion as to the Territory in which these mines are situate, would be presumption. Yet it is generally believed that the line between the Territories lies to the west about 15 miles, and for legal purposes the authority of New Mexico is recognized. The mines lie just south of the Overland Mail and Stage road, and the bold croppings may be seen distinctly 15 miles distant either way on the road. They lie at the extreme north end of the Pyramid range of mountains, where they lose themselves in the open, level country, 45 miles east of Camp Bowie, at Apache Pass, and 70 miles southwest of Camp Bayard; by the sinuous road of Tucson, 150; and west of Mesilla on the Rio Grande, 120. The stage passes weekly over this route, once each way, with the mails and passengers to Tucson and Mesilla. Fare to Mesilla, $35; to Tucson, $42 50; and thence to San Diego, $90—two trips each week west of Tucson. Accommodations are about the same as usual on the frontier routes. In Tucson and eastward greenbacks are always understood when dollars are mentioned; fractional currency, even down to five cents, is in use. We have not seen any silver change for weeks. It looks awkward to see poker and faro games played with a currency that requires careful scrutiny; but the sports use it without any extra profanity, and accept it kindly when fortunate enough to have it offered.

THE ORE — QUANTITY AND QUALITY.

I arrived here only yesterday and have been incessantly seeing the sights up to this evening. Up to yesterday there were 1,257 original claims recorded, and they cover a scope of country about six miles in extent. But three monster veins are prominent—Harpending, Brown and Arnold. They crop out for miles, in places 50 feet above the surface, and verging from a few to hundreds of feet in width. Interveining the vein lodes is a network of smaller ones, many of which are from 10 to 50 feet in thickness. The limited amount of labor performed forbids any correct opinion of worth, regarding the casing of the veins, extent or character much below the surface. In a few places slate walls have been exposed by the miners to a depth of several feet. Quite an extended observation of quartz operations in the Pacific States and Territories has convinced me that more failures have ensued because of a lack of ore than on account of its barrenness of gold and silver. Here the quantity is apparently unlimited. I was disgusted in advance with what I considered the same old stories about 'any amount of ore—rely upon that.' I felt that all former lying had been rendered insignificant in comparison. Yesterday and to-day I carried a hammer, climbed up over the scraggy croppings in scores of places, and knocked off pieces where others had not, and the amount of quartz in sight is so great as to make one doubt his sight—almost regard himself in the midst of a wild dream. I have neither seen nor heard any exaggerations with reference to the quartz in this district.

The quality is still a matter upon which the honest and well-informed may and do differ. I to-day saw boxed some forty pounds of ore from various mines, and addressed to A. Harpending, San Francisco, to be forwarded by stage to-morrow. It may be taken for specimens, but I'm sure there are many thousands of tons equally as good in plain sight. If the ore which P. Arnold has forwarded to Mr. Harpending gives satisfactory returns of gold and silver, there can hardly be a doubt taht this is the most extensive deposit of rich quartz ever found in America. The same quality of ore is abundant throughout the district. It is exposed in thousands of places, and not in small bunches. Speaking only by comparison with other ores, I believe those of this district will be proved of great average richness. I understand the tests so far made have shown but little gold; yet to-day I struck a small pocket which contained much free gold, as was verified by pulverization and careful washing. Unquestionably silver largely predominates.

EVIDENCES OF FORMER WORKING.

There are many evidences that these mines have at one time been worked in a crude way and the ore taken elsewhere for reduction, and that some of the mysterious and fabulous tales of silver mines in Mexico had their origin here. On the Roberts claim, on the Brown lode, is an old stone cabin. It was covered in the usual Mexican style, until recently, when some soldiers set fire to it and burned off the roof. It was covered with cedar poles, thatch and dirt. A hole near by, where the mortar was probably mixed, is grown up with small shrubs, and a portion of the limbs of a cedar tree adjacent have been cut off, and the marks of the axe are yet visible in the dead branches. The work must have been done many years ago. In the quartz near by, there are crevices worked out into the heart of the ledge, some of the cavities being large enough to admit a man on his knees, and when discovered, the entrances were closed with rocks. In other places ore has evidently been taken from the surface, as the 'deads' are as orderly placed to one side as is the practice of modern miners. At this city springs were dug out and walled up. Flat stones used in grinding grain for food are lying about. The careful observer here has no doubts regarding these statements. The Apache Indians killed and drove men from highly cultivated farms in many sections of the region of country—why not from mines?

ACCESSIBILITY OF THE MINES.

Large teams can easily reach the majority of claims, and with very little labor roads can be made so as to admit of heavily laden wagons passing to and from any of them with ease. The hills rise gently, and are covered with a heavy growth of nutritious grass and scattering cedar timber of the scrub variety; are not rocky except near the veins, and there the bowlders are quartz croppings. In most all quartz districts the item of roads is a big one in the expense account, here it will amount to nearly nothing.

WATER.

In the gulch passing up through Ralston, water is abundant in the rainy season and for some time thereafter on the surface; new wells have been dug from 5 to 25 feet. Several have been sunk, and in every case excellent water has been obtained at the depth stated. Half a mile over to the west is a spring; in one of the claims water has been found. While there is no surface water at present, it is proven that the earth is full of it near thereto. Mr. Arnold, who, by the way, is the Superintendent of the Roberts & Harpending Company, and a hard-working, reputable man locally, and I believe generally and specially, is now sinking a well near by, with a view to procure sufficient water for a mill. He is down less than ten feet and has found, up to this writing, considerable water. His intention is to sink, if possible, 30 feet or more. This is the driest season; rain should commence in June. With proper effort, I am confident it will cost less to supply a large population with an abundant quantity of fine water that it did in Virginia City. The San Simon river can be reached by pipes—so I am informed—at a cost not to exceed that of the White Pine Water Works. While it would be quite acceptable if the district were coursed with babbling brooks at all seasons, the scarcity of water here is no great objection.

WOOD.

This article is scarce near at hand. Upon inquiry of a largely interested party of what would be the cost of wood delivered here in quantities of 1,000 cords and upwards, he was frank and prompt in declaring it at not 'above $20 per cord.' Wood is said to be abundant not above 20 miles distant, and known to be within 30 miles. Good pine lumber is selling at 15 cents per foot. When the demand becomes large the price will be greatly reduced. For firewood, there is ample cedar scattered about within a few miles, to last for some time, but it is too limited to be considered in making estimates for permanent supplies.

THE GILA RIVER

Can be reached with a railroad in 45 to 50 miles, according to local authority. A broad level, grassy valley intervenes. There is ample water power, and the mountains which hug that stream above possess immense forests of superior timber. Should this immense field of ore prove half as rich as appearances indicate it will, I predict the early construction of a railway to the Gila, as a means of reaching cheap motive power and fuel. Dumps along the body of the Harpending and portions of the Brown lodes could be reached with cars at a fourth the expense it cost to reach the dumps of the Comstock.

THE CLIMATE

Is pleasant. Days warm but breezy and not oppressive, and nights cool. Is regarded as very healthy. There is nothing in the surroundings to change this opinion, which of course is one formed within a few months by the oldest residents. No one has consented to occupy a graveyard yet, and therefore no cemetery is located.

COST OF LIVING.

Living is dear. Everything but postage stamps sell at enormous profit, and this is throughout all this section of country—from Fort Yuma eastward. Bacon sells at 60 to 75 cents; sugar the same; beef and mutton, 25 cents; flour, 10 cents, etc. Goods and provisions are not plenty, but so far as the assortment goes, enough for the demand. Stocks are ordered from Chicago and St. Louis *via* Sheridan. I am told that freight can be laid down here inside of 10 cents currency from those cities, and that a revolution in retail prices must ensue. As is always the case in new and remote places, certain lines of goods bring any price asked; as a rule merchants' liberality seldom appears to good advantage except under sharp competition. The population is estimated in and about the mines at 300. Many are coming and going.

LITTLE ACTUAL MINING

Is prosecuted. Assessment work is the main business, aside from building, which is necessarily limited, although there are several comfortable houses of stone, adobe and granite, and more building. Owing to the danger from Indians and distance from supplies, but little is required to hold claims under the local laws.

CAUTION TO IMMIGRANTS.

A notice duly recorded holds six months; a shaft 5 by 5 and 6 feet deep will hold a single claim of 200 feet, or all the claims of any one company on the same lode, for one year. Men without some means should stay away until there is a demand for labor, which is very limited now, and will be for the next six months. There are men here who have bummed their way, and without the means to buy a meal or pay for recording a claim, should they find one. If they could subsist on raw quartz, this would be a poor man's paradise. It is a friendly act to often warn them to stay away. The mass of the people here are unable to maintain healthy paupers, and a little starvation is good for such mendicants. Quartz operators of means ought to visit these mines. They could but be delighted to witness more good-looking ore in sight than has ever been worked in the mills in and about Virginia and Gold Hill. Veins of fine-looking ore, standing 50 feet above ground, ranging in width from 10 to 200 feet, form a prospect of enchantment to all mining enthusiasts.

SOLVING THE PROBLEM.

As mining experts are constantly making themselves ridiculous by giving learned (?) opinions on mineral deposits, I shall not in the least attempt to divide the honors with them. Assays tell well for this ore; it remains for hundreds of tons to be worked in a body by mill-process, to establish the worth of this district. J. W."

Michigan.

HARD TIMES IN THE COPPER REGIONS.

The Portage Lake *Gazette* says, that in consequence of the low price of copper, the Huron Mining Company has suspended operations, and the Pewabic, Franklin, and Cliff mines are preparing to follow suit by July 1. It is expected that others will do the same, and that by October there will be but six mines at work in the entire Lake Superior copper region. In consequence, a large percentage of the population will have to seek employment elsewhere. The cause of the dull times in the copper business is the fact that the production of copper, stimulated by the excessive demand during our protracted war, became too great for the consumption of the country in the time of peace. Government, instead of being a purchaser, not only withdrew from the market, but came in direct competition with the mines by disposing of old war materials, accoutrements, and old vessels broken up, which threw upon the market some 5,000 tons of copper in addition to the regular production of the mines. The result of this was the creation of a large surplus stock, which had the effect to depress prices, and to limit the sale of copper to the actual consumption. With a general revival of the business of the country it is believed that consumption must increase and prices advance to a point that will render a working of the mines again profitable. The *Gazette* thus reviews "the situation": "The production of copper, stimulated by the excessive demand during our protracted war, became too great for the consumption of the country in the time of peace. Government, instead of being a purchaser, not only withdrew from the market, but came into direct competition with the mines by disposing of old war materials, accoutrements, and old vessels broken up, which threw upon the market some 5,000 tons of copper, in addition to the regular production of the mines. The result of this was the creation of a large surplus stock, which had the effect to depress prices and to limit the sale of copper to the consumption, which, by careful investigation, has been computed to be about 20,000 lbs. per annum. It is estimated that the stock on hand in the market at this date is about 6,000,000 lbs., from which has been exported 3,500,000 lbs. surplus, against 10,000 lbs. the year previous. The product of our mines last year was 23,483,079 pounds ingot copper; the mines closed during the year, and those which will close by July 1 will make a production of about one-half of the amount they sent to market last year, say 2,771,000 pounds, while the Hecla and Calumet will produce 2,000,000 pounds more. From this data it may be fairly estimated that the whole product from our mines sent to market this year will not exceed 23,000,000 pounds; from Vermont, Tennessee and Baltimore smelting works, 6,000,000 pounds, which, with the surplus on hand, makes 31,500,000 pounds; Government has no longer any old stock to throw upon the market; general business, after its long depression, may be expected to revive after Congress rises, and with its resumption an impetus to all manufacturing business, creating a more active demand for our staple, and with a product so near the actual consumption, it is difficult to conceive why the price should remain so much below the cost of importation, which, at the present low price abroad, and rate for gold, is 24 cents. Nor can we understand why manufacturers are able to sustain a price from 31 to 33 cents per lb. for manufactured copper, which costs them but 19½ cents per lb. in the ingot, while the difference in England is but three cents per lb. Certainly the producers are entitled to a small proportion of their profits, and with the stoppage of so large a number of the leading mines, we trust the few who now compose the copper market will have the will, and they have the power, to advance the price to an approximation to the cost of importation, and instead of allowing the manufacturer to make a profit of 64 per cent., let him be content with 33 per cent., at which rate our mines, with strict economy, could manage to live."

THE SCHOOLCRAFT IRON COMPANY.

At the annual meeting of the stockholders of the Schoolcraft Iron Company, held at Marquette, June 14, for the election of directors and the transaction of other business, the following directors were chosen: Peter White and James Pickands, of Marquette; P. C. Van Schaick and Charles J. Martin, of New York; and Thomas Sparks, Wm. M. Baird, Thomas A. Biddle, Isaac S. Waterman and John Turner, of Philadelphia. The general office of the company will be removed to Philadelphia, where the new board will hold a meeting for the election of officers at an early day. "We understand, says the Marquette *Mining Journal*, that the company will issue bonds to the amount of $120,000, to pay off all indebtedness, and to further the business of the company at the location. The new board is a particularly strong one, and as they now seem to be fully awakened to an appreciation of the value of the property, we shall look for an increased activity in operations at the furnace. A portion of the Philadelphia directors were the original proprietors of the old Grand Island Company."

Colorado.

ITEMS OF MINING NEWS.

The Georgetown *Miner* of the 10th instant has the following: The gulch miners at and near Idaho are doing finely. They have plenty of water and pleasant weather. More mining, of this description, is now being done than for several years past. The Syracuse mill, situated just above Fall River, is now running, and is doing well. Mr. GILBERT, the lessee, is mining on the Rasbeck, and other lodes, with good success. Mr. BATEMAN, who is mining on a part of the Edgar lode, is raising some fine ore. The vein shows about two feet of rich mineral, which assays about $400 to the ton. The Edgar is a large lode, and has the appearances of a rich and continuous vein. The Whale Company propose to start their mill agoing about July the 4th. We are assured that the mine is in a good shape for furnishing ore, and that enough can be mined to keep the mill steadily engaged.—Blazing Star lode is being worked at present by Mr. C. BARTON. The lode is said to have furnished many magnificent specimens of purple copper. The ore is, we are told, both rich and abundant. Two bars of silver, the product of second-class Terrible ore, treated at Stewart's mill, have been shipped eastward since our last issue. One of the bars weighed 1,015 ounces, being .782 fine, and is valued at $1,026 37, coin basis; the other one weighed 1,004½ ounces, being .820 fine, and is rated $1,064 97, coin valuation. Chloride lode, in Spanish Bar District, between the Edgar and Shaffter lodes, is now being worked by Mr. JOHN BAKER. The crevice is five feet in width, three of which are properly pay matter. The ore (chloride), is rich, assaying as high as $350 per ton; the average of the pay matter will probably mill over $100. Mining is vigorously carried on in the section of country around Idaho. In Chicago Creek, Hukill Gulch, Spanish Bar, and Fall River, there must be a large number of men at work, all of whom seem to be doing well. The lodes in the localities named appear to be characterized by a plenteousness of mineral. We are not informed as to its average righness. The Shaffter lode, in Idaho District, is looking well. Mr. BAKER, who is working this lode, has taken out about fifteen tons of ore, ten tons of which will be treated in the Thackara's mill, in Hukill Gulch. Mr. Baker is putting up two arastras to treat his own ore, which, being now more carefully selected, will yield more largely than the first lot which was treated by Thackara.

ANOTHER TUNNEL ENTERPRISE.

The Georgetown *Miner*, June 9, gives a sketch of the prospectus of a tunnel company that proposes to run into Leavenworth mountain and test the value of the various lodes thereon at a greater depth. Says the *Miner*: Leavenworth mountain is threaded

throughout with true-fissure veins, many of which must prove to be of astonishing width, and, therefore, capable of yielding an unlimited supply of valuable mineral. In the list of principal lodes, there is the Argentine, the Tom Thumb, the George Law, Rocky Mountain, and a great many others, all situated on the southernmost face of the mountain above named, easy of access, and are yielding, so far as worked, large quantities and handsome dividends. These lodes are so situated that one or more tunnels would intercept them to a good advantage. The company is composed of the owners of property in that locality. Mr. M. ANKER has the objects of the new corporation in hand. The whole length of the Rhodes tunnel, one of the three projected, will be 3,575 feet. It will pass under the summit of the mountain at an estimated depth of 970 feet. We understand that the company intend to drive ahead energetically until the grand consummation shall be reached.

Missouri.

According to the Irontown *Enterprise*, June 2, the extension of the Iron Mountain Railroad will cause the re-opening of many rich mines in the Big Creek country, which have long lain dormant in consequence of there being no means of transporting their product to market. Says our contemporary: "It has long been known that the Big Creek country was rich in lead ores, as well as other minerals, and as it is now certain that the railroad will pass down that stream for some distance, at least, we hope efforts will be made to develop this wealth. The mines a few years since opened by Judge Emerson, and now opened by gentlemen in the East, are known to be rich in mineral, and would undoubtedly prove very valuable if properly worked."

Pennsylvania.

A correspondent of the Carbon *Democrat* gives an account of the opening of new iron mines of the Pequent Mining Company, which are situated on the river of that name, about six miles above Belvidere, the county seat of Warren: "The tract contains 162 acres, and one vein of twenty-eight feet, and another of sixty-five feet, are being successfully operated, averaging, with the present limited fixtures, about fifty tons a day. Already, a thorough-cut opening has been made below the upper openings, and a gravity railroad is piling up tons of pure ore. The ore is teamed about one and a quarter miles, to a sideling along the Delaware, Lackawanna and Western railroad, and large quantities have already been shipped to furnaces at Danville, Pa., and the Thomas Iron Works at Hockendauqua. Professor OSMUN, of Lafayette College, Easton, is preparing a survey and map of the location; and the same gentleman, having analyzed portions of the ore, finds it produces a neutral iron, a quality of great importance to iron producers. The soil has been tapped at various points from the original opening, and positive indications have been obtained of a prolific supply of the heavy metal."

SPECIAL SCIENTIFIC BREVITIES.

A CORRESPONDENT of the London *Athenæum* gives an account of the Kola nut of Western Africa, which is highly esteemed by the negroes, and forms a very important article of commerce in the native markets. "The nuts possess," he says, "an agreeable, bitterish, astringent taste." "They have," says our correspondent, "the effect of preventing hunger, strengthening the stomach, and enlivening the mind. A man can perform a day's journey upon a single Kola nut, and if eaten at night they prevent sleep. I have long wished to introduce them to the notice of literary men and those who have much mental work. I can testify myself to their restorative properties, when fatigued by mental application and oppressed by the heat of the climate. The way for Europeans to use them is thus:—Take half a Kola or a whole one, well masticate, swallow the juice, eject the residue, then drink cold water; and 'the bitter water shall become sweet,' for a peculiar and very pleasant flavor is imparted to it." The tree furnishing the nuts is also cultivated in the West Indies and in Brazil, to which countries the seed has been introduced through the medium of the traffic in slaves—one point in favor of the slave trade! The botanical history of the tree is well known, one curious circumstance therein consisting in the fact that the seeds have sometimes four or more cotyledons, instead of the usual dicotyledonary structure. The chemical nature of the seed is not so well known, and it would be very desirable that further analyses be made of it, to give the explanation of the properties assigned to it by the natives, among which we may mention that of purifying water.

THE tinning of iron without heat cannot succeed, unless the bath used for that purpose contains, in solution or suspended, an organic substance like starch or glucose, although no precise scientific explanation of this indispensable condition has been hitherto given. Mr. J. B. A. Daubié employs the following bath: To 100 litres of water are added 3 kilos. of rye meal; this mixture is boiled for half an hour, and next filtered through cloth; to the clear but thickish liquid are added 100 kilos. of pyro-phosphate of soda, 17 kilos. of protochloride of tin in crystals (so called tin-salt), 67 kilos. of neutral protochloride of tin, 100 to 120 grms. of sulphuric acid. This liquid is placed in well made wooden troughs, and serves more especially for the tinning of iron and steel wire (previously polished) for the use of carding machines. When instead of the two salts of tin just named cyanide of silver and cyanide of potassium are taken, the iron is perfectly silvered.

A METHOD of obtaining metallic iron by the electric current is announced in the *Chemical News*: "C. Collas employs a weak solution of chloride of iron, which is decomposed by the aid of a Bunsen battery. Perfectly pure iron is thus obtained, which is very friable, highly oxidizable, especially when moisture is present. When the atmosphere is very moist, the iron is instantaneously oxidized, and the evolution of hydrogen causes the bursting of the bottle.

THE production of a crystalline alloy of zinc and calcium has been observed in the preparation of calcium by the process of M. Caron, in which an excess of zinc was employed. It contains about 95 per cent. of zinc and 5 per cent. calcium, corresponding to the formula $Zn_{12}Ca$. These crystals are small octahedrons with square bases. They are acted upon by water, with the liberation of hydrogen.—*Pogg. Annal.*

THE Grand Vizier has reported to the Sultan in favor of the adoption of the French Metric System in Turkey, and the *Levant Herald* gives a translation of the report and law. New names are to be given to the several denominations, which, except in the case of the kantar and the ton, do not embrace the previous names. The oke very nearly corresponds to the kilogramme. The law is to be brought gradually into operation.

MM. BECHAMP and ESTOR, of Montpellier, in a memoir on the composition and formation of blood, try to demonstrate that respiration is a species of fermentation.

ON DITS ABOUT MINES AND METALS.

AN improved machine has been invented by Mr. J. GRAFTON JONES, for breaking down coal, superseding the use of gunpowder and hand-driven wedges. This machine, which is of power sufficient to break down or lift the strongest coal (after it has been holed), is so much improved that it can be inserted into a hole only 2¼ inches in diameter, and with it one man exerts a force equal to a pressure of 200 tons, while its weight complete, including the wedge or pressing blocks, does not exceed 40 lbs. This truly wonderful result has been arrived at by repeated improvements in construction, which consist in substituting for the ordinary force-pump (the valves of which cannot be made to sustain the great pressure required) a screw pump, and screw conical steel plugs in place of the usual valves; these plugs have been proved to hold water-tight against a pressure of more than 100 tons to the square inch. The introduction of this screw pump and of the plug valves has reduced the weight to one-fourth of what was necessary to obtain the same power with the best plunger pumps. The holes into which the machines are inserted can be put in with the improved drill in from five to fifteen minutes, according to the size and nature of the mineral.—*Mining Journal.*

A SIMPLE and efficient form of safety apparatus for the prevention of accidents in coal and other mine shafts from the breakage of ropes and from over-winding has been invented by Messrs. DENTON and WHITAKER, of Leeds. It consists of claws, which are made to grip each side of the guide-rod by the use of a coiled spring. Whilst the cage is in motion with the rope sound, the pull upon the spring prevents its action, but in case of breakage the spring is released, the claws take into the guide-rods, and the fall of the cage is arrested. The arrangement for preventing over-winding consists of a simple latch, held in position by a spring, and in case of over-winding the back end of the latch comes against a stop, and lets the ring connecting the rope with the short chains of the cage escape. The apparatus has been very favorably spoken of by practical men who have seen it in operation, and it is anticipated that its simplicity, and consequent cheapness, will ensure its very extensive adoption.

A CORRESPONDENT writes to the London *Mining Journal* that there has been a great discovery of coal near Denver, Colorado, and if it should prove on examination only about one-half what is represented it will be an important discovery indeed, for the Pacific Railway can then be supplied with coal in a central point of its course, instead of taking it from its extreme ends. Two specimens sent me I have recently been analizing, and find they will do very well for the generating of steam, but are too light for iron furnaces; it is a lignite of first-class quality, very brilliant, burns with a strong flame, has the odor of bitumen, gives out great heat, very little sulphur, does not coke well—that is to say, the coagulation is slight. The samples I had were small, so I could not duplicate the tests; the two I tried gave as follows: water, 9.50; volatile and bituminous, 39.65; carbon, 42.70; ash, 8.15=100.00. The carbon was very spongy, and absorbed nearly eight per cent. of moisture from the atmosphere within 48 hours after exposure.

THE BESSEMER works of the Cambria Iron and Steel Company are enclosed in a large brick building, roofed with iron and slate. The structure is divided into converting room, 160x106x35 feet, engine room 60 x 40, and boiler room 60 x 45 feet. The engines and machinery were made in the Cambria Company's shop. There are two converters of a capacity of five tons each. Two vertical blowing engines furnish the blast at a pressure of about 25 lbs. per square inch. One large duplex pump operates the hydraulic canals, etc. A smaller engine drives the blower furnishing wind for the cupolas and air furnaces, in which the iron is melted previous to conversion into steel. The capacity of the works is about 40 tons of rail ingots per day.

THE Grass Valley, California, *Union* says: "We have seen bogus gold dust which the Chinamen make. The heathan is expert in the matter, and he can deceive almost any buyer of gold. The Chinamen make gold dust out of silver half-dollar pieces. They cut up the silver coin into small particles, which resemble in shape the gold dust found in the streams. This is then colored to resemble gold, and it is mixed with genuine gold dust. How the yellow color is put upon the silver is a Celestial secret. The profit of the business must be great, as two silver half-dollars make almost an ounce of gold-dust, worth about eighteen dollars."

IF published statements are true, the ore from the new tin mines of San Bernardino, Cal., now on its way to San Francisco, contains a considerable percentage of silver. This metal is frequently associated with copper and generally with lead, but its presence in tin ore is unusual. It will be found a very valuable addition, for its extraction will much lessen, if it does not entirely offset, the cost of reducing the inferior metal. The silver in the lead ores brought to San Francisco operate in this way, and the yield is sometimes very handsome.

THE Maramac Iron Works, in Phelps county, Mo., are driven by a large spring, which discharges 10,000 gallons of water per minute. There is a bank of specular iron ore one-third of a mile from the furnace, and it has been supplied from this for many years. The shipping point for the product is St. James, on the South Pacific Railroad. The shipments last year consisted of 300,000 pounds of pig iron, 500,000 pounds of blooms, besides large quantities of hollow-ware castings, which are also manufactured near by.

A COMPANY is at present sinking a coal shaft at Mingo, three miles below Steubenville, on the Ohio. They are now down over two hundred feet, and have nearly reached the vein of coal. They propose erecting blast furnaces and a rolling mill. By the way, it is said by parties well posted that nails can be made and sold here for twenty-five cents less on the keg than in any other place in the country. This is owing to the excellence and cheapness of the coal.

A CORRESPONDENT of the Sharon, Mercer county, Pa., *Herald*, having stated that the supply of block coal in that vicinity was well nigh exhausted, Mr. JAS. WESTERMAN comes out in a card contradicting the statement as false, and says that the Westerman Iron Company alone have reason to know that they control three million tons of block coal, without considering the Greenfield coal territory, which is also block coal of the very best quality for furnace purposes.

THERE is a renewed oil excitement at West Hickory, Pa., and the various roads leading to the Forest county oil regions are lined with pedestrians wending their way over the hills in search of leases and employment. Buildings are being erected, and oil rigs are springing up like mushrooms, reminding us of Pithole in its palmy days.

MINING interests in Eastern Oregon are unusually promising. The shipments of bullion by the "Moses Taylor," which sailed on the last trip for San Francisco, amounted to $50,000.

MISCELLANEA.

Dr. JOHN WILKINS, in the *Philosophical Transactions*, in the year 1666, in which he describes the quicksilver mines at Priuli, in the Venetian territory, says that, although the miners stay under ground only six hours at a time, all of them die hectic, or become paralytic. He saw there a man who had not been in the mines above half a year before, so full of mercury, that on putting a piece of brass in his mouth, or rubbing it between his fingers, it immediately became white like silver, and so paralytic was the unfortunate man, that he could not with both his hands carry a glass half full of wine to his lips without spilling it—though, the doctor quaintly adds, he loved the wine too well to throw it away. Shaking palsy and salivation appear to be the consequences of exposure to the vapor of mercury. Barometer makers and looking-glass silverers are both liable to these affections. Dr. Christison relates a case of a barometer maker and one of his men, who were exposed one night, during sleep, to the vapors of mercury from a pot on a stove in which a fire had been accidentally lighted. They were both most severely affected, one with salivation, which caused the loss of all his teeth, the other with shaking palsy, which lasted to the end of his life. Chemists who have to work much with metallic mercury often suffer from the effects.

IN Paris, from the 9th July, 1866,, when the first horse-flesh butchery was opened, to the 31st December in the same year, 902 horses (a few mules and asses being included) were slaughtered, and their flesh averaging for each about 440 lbs. in weight, gives a total of about 180 tons; in 1867, the total consumption of this kind of meat rose to 430 tons; and in the following year it amounted to rather more than 480 tons. In these two years and a half the totals were 5,475 horses, yielding 1,095 tons of meat, without including the livers, tongues, hearts, &c., which were also used as food. The price of horse-beef in Paris is less than half that of ox-beef. The returns for the rest of France are not complete, but judging from partial accounts, and according to the number of towns in which this kind of meat is used, the committee believes that the total consumption amounted, in 1868, to 2,000 tons.

We find in one of our English exchanges an account of a so-called new stone breaker, which is, in fact, nothing but a feeble attempt at an evasion of Blake's patent. "In constructing the apparatus, the fixed jaws are placed vertically, as in some of the machines now used, but the crushing block or movable jaw is made with two faces or working surfaces, and this block is made to oscillate on a centre placed either above or below a central point midway between the two fixed jaws. As an obvious modification, instead of a single oscillating block, two movable blocks, connected together by links or other equivalent devices, but mounted on distinct shafts, may be used. It is preferred to actuate the crushing block or blocks by means of an eccentric mounted on a horizontal shaft, which passes through an opening made in the block or between the two blocks."

ACCORDING to the *Gaslight Journal*, walls of remarkable lightness, porosity, and dryness may be built cheaply of bricks made from the ashes of the coke derived from gas-works. Mr. Wagner, the first inventor of the process for effecting this, instructs us as follows as to his *modus operandi*: "The ashes, after being taken from the retorts, are spread on the surface of a clean floor; they are then finely pulverized, and ten per cent. of slacked lime, together with a small proportion of water, is intimately stirred and incorporated with them. After a rest of twenty-four hours, the mixture is made into bricks by the ordinary process. These bricks are immediately transferred to the drying sheds, where a few days' exposure renders them fit for use."

IN Europe, as in this country, no satisfactory method is in use for warming railway carriages. The *Engineer* notices a new plan adopted in Bavaria. A special van is attached to the train and contains a powerful "calorifere," and the heated air is conveyed to all the carriages of the train by means of india-rubber tubes. The experiment with first-class carriages is reported upon so favorably that the authorities have determined to apply it to all the carriages on the Bavarian lines, and it is expected that it will soon be adopted on all the German railways.

SETH GREEN, who has made the subject a study, says that one of the chief causes of the destruction of young trout and whitefish is a worm that spins a web very much like that of a spider. Though this web is not strong enough to hold the young trout, it sticks to their gills and fins, and soon kills them. This seems very much like justice, for the worm is a favorite food of the full grown trout. The web can only be spun in still water.

THE editor of the *American Grocer* bought some cream of tartar, a short time since. Upon analysis, he found the sample to contain 83 per cent. of sulphate of lime (plaster of Paris) and the other 17 per cent. composed of starch and sulphuric acid, without a trace, so far as the examination extended, of bi-tartrate of potash (cream of tartar).

ACCORDING to the Panama *Mail*, work on the Honduras interoceanic railroad is rapidly progressing. Senor Alvarado, one of the Ministers, was on the Atlantic coast superintending the embarkation of the dyewoods, which are to be sent to Europe on account of the loan raised in London and Paris.

RECENT advices from Guatemala state that surveys are being made by some engineers for a railroad to run from the Capital to the northern coast through the departments of Guatemala, Santa Rosa, Jutiapa and Chiquimula, and the engineers were about to continue work on towards port Santo Thomas.

THERE are, according to the *Turf, Field and Farm*, one hundred and twenty steamers plying between the United States, Great Britain and the north of Europe. Total tonnage, 254,259 tons. The amounts received for freights, passage money, outfits, etc., in the countries where they are owned, $106,183,000, currency.

THERE is a project on foot in Paris for the formation of a museum containing the best examples that can be found of the various types of the human race, not for scientific purposes only, but also in the interest of Art. M. Charles Rochet has introduced the subject in a lecture at the Sorbonne.

BUSINESS AND PERSONAL.

[*Short notices in this column fifty cents per line each insertion.*]

GLYNN'S ANTI-INCRUSTATOR FOR STEAM BOILERS.—THE only and reliable article for removing and preventing incrustation. No foaming, and does not attack metals of boiler. Liberal terms to agents. C. D. FREDRICKS, 587 Broadway, N. Y.
April 19 tf.

MARKET REVIEW.

The Coal Trade.

NEW YORK, July 1, 1870.

WHOLESALE.—There has been an active trade doing the past week, which to-day has only slackened a little, owing to the close approach of the anniversary of our National Independence. The increased demand noted in the trade during the past three weeks, received an additional stimulus in the Scranton Auction Sale of Wednesday last, at which, agreeable to our prediction, prices materially advanced. That this advance will be maintained throughout the balance of the busy season and year, we think there is no doubt. The Schuylkill county mines are yet idle, as are also those of the Lehigh Coal Navigation Company; but as the majority of the miners employed in these localities are now at work in the busy regions, the strike virtually amounts to nothing. This can be plainly recognized by the increased production we have from the other regions, which could only have been expected by an emigration of the miners. The only thing we feared was a forced decline in prices, which would have sent the entire coal producing regions on a strike, in which event, pending the disorganization, prices might have run up to a high figure, only to collapse at the resumption of operations, which would have made the entire coal business speculative. While we do not like to point to any particular party as a "bull" or "bear" in the coal market, we do not hesitate to say that the action of the Pennsylvania Coal Company, in the issuing of their July circular, quoting reduced rates, *with no coal for sale*, was nothing short of a fraud on the trade, and a mean attempt to demoralize and "bear" the market. We do not question the right of any merchant to set a price on his wares, but when that merchant is supposed to hold an influence, it is best for him, in order not to lose such influence, to have for delivery to everybody and anybody, the goods he offers.

The Pennsylvania Company might, with equal propriety, offer coal at $2 50 per ton, but what signifies it if they can't deliver. The object of the circular was evidently to cause a decline at this last sale, but it seems to have had no effect at all, and was properly treated, as it deserved, with contempt. We have alluded to this same trick once or twice before, and shall expose it every time it is attempted. We think it only justice to our subscribers, who are mostly retail dealers, to thus warn them of their danger. Below will be found a complete report of the Scranton Sale, compared with that of last month. The sale was well attended, and the lots were readily taken at the advance noted.

AUCTION SALE OF SCRANTON COAL, JUNE 29TH, 1870
—J. H. DRAPER, AUCTIONEER.

1870.		May 25.	
10,000 Tons	Lump	$4 05	@ 4 22
12,000 "	Steamboat	4 10	@ 4 20
15,000 "	Grate	4 25	@ 4 37½
13,000 "	Egg	4 50	@ 4 52½
20,000 "	Stove	5 00	@ 5 10
10,000 "	Chestnut	4 20	@ 4 30
80,000			

1870.		June 29.	
11,000 Tons	Lump	$4 00	@ 4 07½
12,000 "	Steamboat	4 15	@ 4 15
15,000 "	Broken	4 57½	@ 4 67½
10,000 "	Egg	4 65	@ 4 70
20,000 "	Stove	5 10	@ 5 25
12,000 "	Chestnut	4 30	@ 4 35
80,000			

By the invitation of the Wilkesbarre Coal and Iron Company, we enjoyed a very pleasant trip to their mines, a full report of which will appear in our columns next week. We regret that its length compels us to lay it over one week.

PRICES.—The advance at the sale has only caused a firmer feeling in the market. All the coal offered is readily taken at our quotations.

FREIGHTS.—Vessels are becoming scarce under the extra demand, and freights have advanced from 10 to 15 cents.

RETAIL.—Owing to the very warm weather, and the approach of the 4th of July, trade is quiet.

Anthracite Coal Trade for 1869 and 1870.

The following table exhibits the quantity of Anthracite Coal passing over the following routes of transportation for the week ending June 25, 1870, compared with week ending June 26, 1869.

COMPANIES.	1869. WEEK.	1869. TOTAL.	1870. WEEK.	1870. TOTAL.
*Phila. & Reading R.R.	78,419	1,348,349	32,506	1,031,904
Schuylkill Canal.....	12,526	185,570	3,467	42,852
Lehigh Valley R. R.	21,013	1,032,560	62,106	1,551,248
Lehigh & Sus. R. R....	10,855	312,937	19,030	471,726
Lehigh Canal..... south	4,077	178,704	23,732	178,704
Scranton North.....	40	206,297	15,970	308,379
" South.....	2,751	595,013	35,214	859,642
Penn. Coal Co., rail....	24,394	444,930	25,694	533,247
" " " canal..	599	6,650	599	6,811
Del. & Hud. Canal Co..	31,969	507,910	51,800	597,823
" " R. R.....	117	98,304	4,680	223,234
" " south	2,240	48,263	13,083	205,741
Shamokin..	5,553	149,377	9,531	155,520
Trevorton.....		7,054	1,153	40,112
Lykens Valley Coal Co..	2,112	27,627	3,267	38,920
Wyoming South		37,391		
P. N. Y. C. & R. R. Co.			6,651	141,655
Williamstown, Col'y....	5,952	65,580	6,832	131,247
Short Mountain		21,562		
Total.....	232,408	5,350,653	374,288	6,602,577
1869.....			202,408	5,350,653
Increase week and year			111,880	1,251,924

* Less coal transported for Company's use and Bituminous coal.

Bituminous Coal Trade, 1869 and 1870.

The following table exhibits the quantity of Bituminous Coal passing over the following routes of Transportation for the week ending June 25, 1870, compared with week ending June 26, 1869.

COMPANIES.	1869. Week.	1869. Year.	1870. Week.	1870. Year.
& O. R. R.....	22,611	434,922	19,778	391,581
C. & O. Canal.....	17,692	221,124	18,671	213,530
P. & B. T. R. R.....	9,620	164,889	7,867	148,785
Harrisburg & D.....			15,452	375,372
L. V. R. R.....		552		....
P. & N.Y. C. & R. Co.			1,607	112,000
	49,923	821,287	63,375	1,241,268

Schuylkill Coal Trade.

Report of Coal transported via the P. and R. R. for the week ending June 25, 1870—less coal carried for Company's use, and Bituminous Coal:

For week,	32,506 15
Previously this year,	1,059,398 04
Total,	1,348,316 00
Same time last year,	1,348,346 00
Decrease,	256,447 01
Amount sent same week 1869.	78,419 00

Amount of coal transported on the Philadelphia and Reading Railroad for the week ending Thursday, June 23, 1870:

From St. Clair	2,236 12
" Port Carbon	3,255 17
" Pottsville	318 17
" Schuylkill Haven	16,466 00
" Auburn	1,159 01
" Norristown	9 08
" Port Clinton	6,573 03
" Allentown and Alburtis	2,487 17
" Harrisburgh and Dauphin	15,452 00
Total paying freight	47,958 15
Coal for Company's use	1,869 15
Total for week	49,618 10
Previously this year	1,422,730 06
Total.....	1,472,378 16
To same time last year.....	1,571,088 13

Report of coal transported over the Schuylkill Canal for the week ending Thursday, June 23, 1870.

	Tons. Cwt.
From Port Carbon.....	892 00
" Pottsville.....	...
" Schuylkill Haven.....	2,216 10
" Port Clinton	359 09
Total for week.....	3,467 09
Previously this year.....	39,114 14
Total.....	42,582 04
To same time last year.....	195,570 15

Delaware and Hudson Canal Company.

Coal mined and forwarded by the Delaware and Hudson Canal Company, for week ending Saturday, June 25, 1870.

	WEEK.	SEASON.
North.....	42,915 15	1,096,438 05
South.....	13,083 07	205,740 14
Total	55,999 02	1,302,178 19
Corresponding time in 1869.		
North.....	....	704,772 04
South.....	2,259 19	47,135 19
Total.....	2,259 19	751,908 03
Increase North	42,915 15	Increase 391,666 01
Increase South.....	10,823 08	Increase 158,604 15
Total Increase.....	53,739 03	Increase 550,270 16

Report of Coal Transported over Lehigh Valley Railroad

For the week ending June 25, 1870, and previously this season, compared with same time last year:

WHERE SHIPPED FROM.	WEEK. Tons.	Cwt.	PREV'LY. Tons.	Cwt.	TOTAL. Tons.	Cwt.
Total Wyoming.....	11,209	15	332,607	09	343,817	04
" Hazleton.....	52,300	10	978,324	15	1,030,630	05
" Upper Lehigh.....	119	19	6,803	02	6,923	01
" Beaver Meadow.....	20,551	06	335,975	09	356,526	15
" Mahanoy.....	3,009	13	119,643	15	222,143	04
" Mauch Chunk.....			447	17	447	17
Total Anthracite.....	87,281	03	1,773,207	07	1,860,488	10
Bituminous Coal recv'd from Cata. R. R.....						
N. C. R. R.....						
E. P. R. R.....	1,607	00	6,622	00	8,229	00
P. & N.Y. C. & R.R. Co						
Fall Creek.....						
Schroeder.....						
Towanda.....						
Total by rail and canal....	88,888	03	1,779,829	07	1,868,717	10
Same time last year.....	21,013	18	1,077,495	07	1,098,509	03
Increase.....	67,874	07	702,334	00	770,208	07
Decrease.....						
Forwarded East from M'h Chunk by rail.....	62,106	04	1,489,141	19	1,551,248	03
Same time last year.....	19,875	01	957,518	16	977,394	03
Increase.....	42,230	17	531,623	03	573,854	00
Decrease.....						

RECAPITULATION.

Forwarded East from M'h Chunk by rail.....	62,106 04	1,489,141 19	1,551,248 03
To N. C. R. R., at Mount Carmel.....		115 00	115 00
Forwarded North from L. & B. Junction.....	6,051 17	135,177 05	141,229 02
To L. & S. R. R. at Packerton for rail.....	64 02	4,031 09	4,095 11
Delivered at M'h Chunk..	5 15	684 07	690 02
Delivered on line of road above Mauch Chunk....	51 05	7,006 19	7,058 04
Delivered above M. Chunk for use of L. V. R.R.....	583 12	28,443 03	29,026 15
To L. & S. R. R., at P'n Hav., for railroad.....			
Do. for canal.....	12,604 01	72,851 06	85,455 07
At M.Chunk for canal....	5,814 07	35,755 19	41,570 06
Total Anthracite.....	87,281 03	1,773,207 07	1,860,488 10
Bituminous Coal.....		6,622 00	8,229 00
Total all kinds.....	88,888 03	1,779,829 07	1,868,717 10

The following is the amount of Coal shipped over the Hazleton Division of Lehigh Valley Railroad, for the week ending June 18, 1870:

COLLIERIES.	WEEK.	TOTAL.
Hazleton.....	10,163 12	287,344 08
East Sugarloaf.....	5,531 02	120,449 15
Council Ridge.....	2,925 14	71,589 04
Mount Pleasant.....	558 02	19,181 18
Harleigh.....	3,817 19	67,423 02
Jeddo.....	3,667 08	106,857 04
Ebervale.....	4,648 14	91,936 11
Milnesville.....	1,495 07	36,276 05
Buck Mountain.....	1,903 11	31,047 19
Cross Creek.....	1,734 04	31,037 13
Ashburton.....		1,290 12
Highland	2,183 11	30,144 12
Lattimer.....	2,326 18	45,089 10
Woodside.....	775 18	13,183 15
	41,770 01	854,380 10

Shipments of Cumberland Coal

for the week ending Saturday, June 25, and for the year 1870:

SHIPPED BY	B. & O. R. R.	C. & O. CANAL.	TOTAL.
Cooke M.....	.....	.....	.....
Borden.....	1,016 11	2,610 09	3,627 00
Consolidation.....	4 2 9 11	7,231 19	11,511 10
Spring Hill.....	600 01	.....	600 01
Midlothian.....	20 09	.....	20 09
H. and Baltimore.....	10 10	1,556 16	1,567 00
do Va M	1,121 00	.....	1,121 00
V C & I Co.....	652 00	.....	652 00
G. C. C. and I.....	2,469 14	692 10	3,162 04
Maryland	3,244 18	6,127 06	9 372 04
American.....	1,939 07	4,250 00	6,189 07
Atlantic.....	503 14	.....	503 14
Piedmont.....	766 00	.....	766 00
Swanton.....	1,267 04	.....	1,267 04
Barton.....	686 00	.....	686 00
Potomac.....	1,385 00	.....	1,385 00
Franklin.....	2,599 09	.....	2,599 09
Big Vein.....	1,760 00	.....	1,760 00
Total week.....	24,321 08	22,469 00	46,790 08
Previous.....	405,859 00	234,107 03	639,966 03
Total year	430,180 08	256,576 03	686,756 11

Statement of coal transported over the Cumberland and Pennsylvania Railroad during the week ending Saturday, June 25, and during the year 1870, compared with the corresponding period of 1869:

WEEK.

YEAR.	C. & O. CANAL. Tons.	Cwt.	B. & O. R. R. Tons.	Cwt.	TOTAL. Tons.	Cwt.
1870.....	18,671	03	19,778	01	38,449	04
1869.....	17,692	17	22,611	12	40,304	09
Increase.....	978	06				
Decrease.....			2,833	11	1,855	05

YEAR.

YEAR.	C. & O. CANAL.	B. & O. R. R.	TOTAL.
1870.....	213,530 12	391,581 19	605,112 12
1869.....	221,124 19	434,722 19	655,847 18
Increase.....			
Decrease.....	7,594 07	43,141 00	50,735 06

Penn. and N. Y. Canal and Railroad Co.

REPORT of Coal Transported via the Pennsylvania and New York Canal and Railroad Company, for week ending June 25, 1870:

	WEEK.	PREVIOUSLY.	TOTAL.
Anthracite.....	6,051 17	....	141,655 01
Bituminous.....	5,720 00	....	112,000 00
Total, Ant. and Bit.....	11,771 17	....	253,655 01

Report of Coal Transported by the Lehigh Coal and Nav. Co.'s Railroads and Canals,

Week ending June 25, 1870—Compared with same time last year.

WHERE SHIPPED FROM	WEEK, 1870. tons ct	WEEK, 1869. tons ct	YEAR 1870. tons cwt.	YEAR, 1869. tons cwt.
Wyoming Region . .	25412 15	14269 12	53024 09	271356 08
Upper Lehigh Region .	3734 13		6118 04	56577 19
Mahanoy Region . . .	88 13		380 17	638 01
Hazleton Region . . .	12849 02		8929 14	52706 14
Beaver Meadow Region	5725 14	755 14	41539 16	24021 15
Mauch Chunk Region .			30089 18	119056 10
Totals . . .	47610 17	15016 06	761112 18	525497 07
Increase . . .	32594 11		235815 11	
Decrease . . .				
DISTRIBUTION.				
Forwarded East of Mch Chunk by Rail . .	19003 10	10665 12	471726 14	312937 12
Forwarded East of Mch Chunk by Canal. . .	23332 15	4077 17	176434 11	178704 11
Delivered at and above Mauch Chunk . . .	885 06	282 17	19423 11	15066 15
Delivered to L. & B. R. R. at Plymouth Bridge	1389 08		93528 02	13688 03
L. V. R. R. at Sugar N.				5100 03
Totals . . .	47610 17	15016 06	761112 18	525497 07
Of the above there was from Mines controlled by Co., W.B.C. & I.Co	13644 05	12787 01	233439 16	137790 15
L. C. & N. Co		12787 01	46743 15	132568 17
Totals. . . .	13644 05		280183 11	270359 12
Increase . . .	857 04		9823 19	
Decrease . . .				

Harrisburgh and Dauphin Coal Trade.

The following is the amount of Bituminous Coal transported via the P. and R. R. for the week ending June 23, 1870:

	Tons.
For week	15,452 00
Previously this year	359,920 10
Total, ...	375,372 10

Prices of Coal by the Cargo,

[CORRECTED WEEKLY.]

SCHUYLKILL.	AT NEW YORK, July 1. R. A.	W. A.	AT PHILADELPHIA, June 30. R. A.	W. A.
Lump.....	$— —	$5 00	4 50	— —
Steamer,.....	— —	5 00	— —	— —
Broken,.....	— —	5 25	— —	4 25 to 4 40
Egg,.....	5 75 to 6 25	5 25	— —	4 25 to 4 40
Stove,.....	— to —	5 75	— —	4 25 to 4 40
Chestnut,.....	4 50 to 5 40	4 75	-	4 00 to -
Pea.....	— —	— —		— —
LEHIGH.				
Lump, (along side)....	6 00	— —	— —	— —
Broken.....	5 75	— —	— —	— —
Egg.....	5 75	— —	— —	— —
Stove.....	6 00	— —	— —	— —
Chestnut.....	5 25	— —	— —	— —
Pea.....	— —	— —	— —	— —
SPECIAL COALS.*				
Diamond Vein.....	R. A.	— —	— —	— —
New England.....	"	— —	— —	— —
Locust Dale.....	W. A.	— —	— —	— —
Honey Brook, Le'h	W. A.	4 75 to 5 75	— —	— —
Spring Mountain "	"	4 75 to 5 75	— —	— —
Sugar Creek... "	"	4 75 to 5 75	— —	— —
Sugar Loaf.... "	"	4 75 to 5 75	— —	— —
Old Comp'y's.. "	"	4 75 to 5 75	— —	— —
Cross Creek... "	"	4 75 to 5 75	— —	— —
Enterprise..... "	"	— —	— —	— —
Girardville..... "	"	— —	— —	— —
McMichael..... "	"	— —	— —	— —
Shamokin..... "	"	5 50	4 50	— —
Lykens Valley. "	"	— —	— —	— —
Broad Top..... "	"	5 50	— —	— —
Hill & Harris.. "	"	— —	4 50	— —
Henry Clay..... "	"	— —	4 50	— —
Powelton..... "	"	5 50	4 50	— —

Prices for Coal at Mauch Chunk.

	F.L.	Bro.	Gra.	Egg.	Sto.	Cst.
Lehigh.	$3 00	$3 50	$3 50	$3 50	$3 75	$3 00
Wilkesbarre....	3 00	3 50	3 50	3 50	3 75	3 00

For freight to Elizabethport and to New York see "Freights."

BITUMINOUS COALS.

Kittaning Coal Co.'s Phœnix Vein..f.o.b. at Phila..	$5 00
" Lemon " " " ..	4 75
Cumberland Vein Coal.....	7 00
Cumberland C. & I. Co.'s on board..... N. Y. ..	7 00
Maryland Coal Co. " ..... " ..	7 00
Consolidated Coal Co.'s " ..... " ..	7 00

[*Dealers in these coals may be found in our advertising columns.]

Company Coals.

	L.	Str.	Gra.	Eg.	Sto.	Ches.
Scranton at E. Port...						
Pittston at Newburgh	4 60	4 60	4 70	4 80	5 10	4 80
Lackawana at Rondout	4 50	4 60	4 70	4 90	5 20	4 50
Wilk'b're at Hoboken.	4 75	4 75	5 00	5 00	5 35	4 60
Old Co. Lehigh at Pt. Johnston.....	— —	— —	— —	— —	— —	— —
Lehigh at E. Port.....	5 50	5 25	5 25	5 25	5 50	4 75

For freights to different points, see "Freights."

Prices at Baltimore—July, 1870.

Wholesale Prices to Trade.

Wilkesbarre, by cargo or car load.....	$5 30@5 50
Pittston and Plymouth, do.....	5 00@5 25
Shamokin Red or White Ash, do.....	5 50@6 00
Lykens Valley Red Ash, do.....	5 40@5 50
Zerba Valley.....	25 50— —
By retail, all kinds per ton of 2240 lbs.....	7 00@7 50
Georges Creek & Cumberland f. o. b. at Locust Point for cargoes.....	4 75@5 00
Fairmont and Clarksburg gas, f. o. b. at L. Point	5 35@5 50

Prices at George'n, D.C., & Alexandria, Va.

July, 1870.

George's Creek and Cumberland f. o. b. for shipping..$4 55

Prices at Havre de Grace, Md.

Wilkesbarre and other White Ash for cargoes ..$— —@— —
Lykens Valley .. .. — —@— —
Shamokin Red or White Ash.. .. .. — —@— —
Trevorton and Zerba Valley .. .. — —@— —

Prices of Gas Coals.

July, 1870.

PROVINCIAL.

Corrected weekly by Louis J. Belloni, Jr. 73 Pine st., N.Y. Duty, $1 25, gold.

	Coarse.	Slack.
Block House.....	$1 75	@- 75
Gowrie.....	1 75	@- 75

Corrected by Bird, Perkins & Job, 86 South street.

	Coarse Coal.	Culm of Coal.
Picton.....	$2 25	@1 25
Sydney.....	2 25	@- 80
Lingan.....	1 75	@- 80
Little Glace Bay.....	1 75	@1 00
Caledonia.....	1 60	@- 80

A discount from the prices of the coarse Coal on purchase of 5000 tons and upwards. Duty $1 25 per ton, gold, on the coarse coal. 25 per cent. ad valorem on the Culm of Coal.

AMERICAN.

	Coarse.	Slack. Currency.
Fairmount Gas Coal Co. of N. Y.....	7 50	@- —
Despard Coal Co.....	$7 50	@- —
Penn.....	— —	@- —
Newburg Orrel Gas.....	— —	@- —
West Fairmount Gas Coal.....	— —	@8 00

AT PHILADELPHIA.

Powelton.....	$7 80

Prices of Foreign Coals.

July, 1870.

Duty $1 25 per ton.

Corrected weekly by PARMELE BROS., No 32 Pine street, New York.

Liverpool Gas Caking	$ 8 00@— —
" " Cannel..	10 00@12 00
" House "	13 50@15 50
" " Orrel.	12 00@14 00

Per ton 2,240 lbs., ex-ship.

PRICES FROM YARD.

Liverpool House Orrel, screened.....	$16 00@17 50
" " Cannel, "	18 00@20 00

Per ton 2,000 lbs. delivered.

Rates of Transportation to Tide Water.

BY RAILROAD.

TO PORT RICHMOND, PHILADELPHIA.

Philadelphia and Reading Railroad, from Schuylkill Haven.....	$2 00

From Port Carbon, 8 cents per ton more.

Less drawback of 80 cents on all Coal shipped east of New Brunswick and south of Cape Henry.

MAUCH CHUNK TO ELIZABETHPORT.

L. V. Railroad from Mauch Chunk to Easton.....	$ 81
C. R. R., N. J., Easton to Elizabethport.....	1 12
Shipping expenses at Elizabethport.....	25
Warfage	10
Total.....	$2 28

MAUCH CHUNK TO PORT JOHNSON.

L. V. R. R., or L. & S. R. R. from M. C. to Easton...	$ 81
C. R. R., of N. J., Easton to Pt. Johnson	1 19
Shipping expenses.....	25
Warfage.....	10
Total.....	$2 35

TO HOBOKEN.

L. V. R. R., Mauch Chunk to Easton	$ 81
Morris & Essex R. R. Easton to Hoboken.....	1 19
Shipping expenses.....	25
Warfage	10
Total.....	$2 35

TO SOUTH AMBOY.

L. V. R. R..	81
R. & D. R. R..	1 09
Cam. & Am. R. R.)	
Shipping Expenses, ...	25
Total	$2 15

PENN HAVEN TO ELIZABETHPORT.

L. V. RR. Penn Haven to Easton	95
C. RR. of N. J. Easton to Elizabethport..	1 19
Shipping expenses	25
Wharfage..	10
Total.....	$2 49

BY CANAL.

Via Schuylkill Canal.

TO PHILADELPHIA.

From Schuylkill Haven.....	$1 07
" Port Carbon.....	1 10
" Port Clinton.....	1 00

TO NEW YORK.

From Schuylkill Haven.....	$1 70

Via Lehigh Canal.

TO PHILADELPHIA.

Lehigh Canal.....	$0 70
Freight and towage..	1 07
Total.....	$1 77

TO NEW YORK.

Lehigh Canal.....	$ 40
Morris "	1 10
Freight.....	
Towing.....	
Total.....	$ 2,50

TO JERSEY CITY.

Lehigh Canal.....	$ 40
Morris "	2 00
Freight.....	
	2 40
For re-shipment.....	2 20
Total.....	$4 60

Via Delaware and Raritan Canal.

TO NEW YORK.

Lehigh Canal.....	$ 40
Delaware Division Canal.....	30
Delaware and Raritan Canal.....	25
Freight.....	1,25
Towage.....	20
Total.....	$ 2,50

TO NEW BRUNSWICK.

Lehigh Canal,...	$ 40
Delaware Division Canal,..	30
Delaware and Raritan Canal,..	35
Freight, ...	1.05
Total, ...	$ 2,10

For Re-shipment—30 extra for shipping, and 10 cents. drawback.

Freights.—JULY, 1870.

TO EASTERN PORTS.	From Philada'Pt.	From E. Port and Port Johnston.	From Newburg...	From Rondout....
Amesbury.....	$2 75	$— —	$	$
Bangor.....	2 75	— —	1 60	
Bath.....	2 00	2 00	— —	
Boston.....	2 00	1 65	2 00	1 75
Bridgeport.....	1 60	1 00	1 10	1 20
Bristol.....	2 00	1 25	1 40	
Cambridgeport.....	2 50	2 00		
Derby.....	2 00	— —		
Dighton.....	1 85	— —	1 45	
East Cambridge.....	2 50	2 00		
Fall River.....	1 75	1 25	1 40	
Hackensack.....	1 95	1 50		
Hartford	2 75	1 35		
Jersey City.....	1 75	50		
Middletown.....	— —	1 25		
Mystic.....	1 75	1 25	1 30	
New Bedford.....	1 75	1 40		
Newburyport.....	2 15	2 00		
New Haven.....	1 70	1 00	1 10	1 20
New London.....	2 00	1 15	1 25	1 30
Newport.....	1 75	1 25	1 40	
New York.....	1 25	50	70	
Norwalk.....	1 70	1 00	1 05	
Norwich..... and tow	1 70	1 35	1 35	1 40
Pawtucket.....	1 90	1 50	1 60	
Portland.....	2 00	1 75		
Portsmouth, N. H.....	2 00	2 25		1 85
Providence.....	1 75	1 40	1 45	1 45
Rockport.....	2 10	— —		
Saco.....	2 50	2 10		
Sag Harbor.....	2 00	1 40	1 30	
Salem.....	2 00	1 60		1 75
Stamford.....	2 00	1 00	1 00	
Stonington.....	2 00	1 30	1 25	
Taunton.....	2 75	2 00		
Warren.....	— —	1 40	1 45	
Washington	1 10			
TO RIVER PORTS.				
Albany.....		90	- 60	
Catskill.....		— —	- 50	
Cocksackie.....		— —	- 50	
Coeyman's.....		— —	- 75	
Cold Spring.....		— —	- 35	
Fishkill.....		— —	- 30	
Haverstraw.....		50	- 60	
Hudson.....		— —	- 50	
New York.....		— —	- 70	
Nyack.....		50	- 60	
Poughkeepsie.....		— —	- 35	
Rhinebeck.....		— —	- 30	
Rondout.....		— —	- —	
Saugerties		— —	- 40	
Sing Sing.....		— —	- 75	
Stuyvesant.....		— —	- 55	
Tarrytown.....		80	- 75	
Troy		90	- 75	
West Point.....		— —	- 35	
Yonkers.....		40	- 60	

Foreign and Provincial Freights.

July, 1870.

Foreign.	
Newcastle and Ports on Tyne, per keel of 21 1-5 tons.....	£14 00@£16 00
Liverpool.....	12s. 6d@14. ton

TO NEW YORK.

Provincial	
Sidney	$—
Lingan	—
Cow Bay	—
Port Caledonia	—
Little Glace Bay	—

TO BOSTON.

Sydney	$—
Lingan	—
Cow Bay	—
Port Caledonia	—
Little Glace Bay	—

Towing Rates.

TO EASTERN PORTS.

	Per Ton.
To New Haven,	$ 40
Bridgeport,	40
Southport,	40
Westport,	40
Norwalk,	40
Stamford,	40
	Per Boat.
Greenwich,	$70 00
Port Chester,	80 00
Mamaroneck,	70 00
Glen Cove,	—
New Rochelle,	55 00
East Chester,	60 00
West Chester,	30 00
White Stone,	30 00
College Point,	25 00
West Farms,	25 00
Flushing,	30 00
Harlem and Mott Haven,	20 00
Port Morris,	20 00
Ninety-first street and Astoria,	16 00

Boats beyond Port Chester, with less than 200 tons, $50 per Boat.

TO RIVER PORTS.

Boats of 150—250 Tons.	*Per Ton.*
To Manhattanville,	8 cents.
Spuyten Duyvil,	8 "
Yonkers,	9 "
Hastings,	10 "
Piermont,	12 "
Dobbs' Ferry,	12 "
Nyack,	14 "
Tarrytown,	15 "
Sing Sing,	16 "
Croton Landing,	17 "
Haverstraw,	17 "
Verplanck's,	17 "
Peekskill,	18 "
West Point,	20 "
Cold Spring,	20 "
Newburgh,	18 "
Poughkeepsie,	22 "
Rondout,	23 "
Boats of 100 Tons	*Per Boat.*
To Manhattanville, and Return,	$11 00
Spuyten Duyvil, "	13 00
Yonkers, "	15 00
Sing Sing, "	20 00
Peekskill, "	25 00

METALS.

NEW YORK, July 1, 1870.

IRON.—Duty: Bars, 1 to 1½ cents ₱ lb; Railroad, 70 cents ₱ 100 lbs.; Boiler and Plate, 1½ cents ₱ lb; Sheet, Band, Hoop, and Scroll, 1¼ to 1¾ cents ₱ lb; Pig, 9 ₱ ton; Polished Sheet, 3 cents ₱ lb.

	Store Prices.
Pig, Scotch No. 1, ₱ ton	33 00@36 00
Pig, American, No. 1	32 00@33 —
Pig, American, No. 2	30 —@31 —
Pig, American, Forge	29 —@30 —
Bar, Refined, English and American	— —@75 00
Bar, Swedes, assorted sizes (gold)	85 00@100 00
Bar, Swedes, ord'y sizes, less 5 ₱ ct. cash	110 —@— —
Bar, Refined " "	— —@ 77 50
Bar, Common " "	72 50@— —
Scroll " "	87 50@115 —
Ovals and half-round " "	95 —@110 —
Band " "	95 —@— —
Horse Shoe " "	95 —@— —
Rods, ¼ to 3-16 inch " "	85 —@120 —
Hoop " "	105 —@145 —
Nail rod, less 5 ₱ ct.	— 7 @—7½
Sheet, Russia, as to Nos. (gold)	— 11@—11½
Sheet, Single, D. and T. Common	— 4¾@— 5¾
Sheet, Galv'd, Nos. 14 to 26 12 and 14 c. 25@30 ₱ c. off	
Rails, English (gold), ₱ ton	59 00 @60 00
Rails, American, at Works in Pa.	71 00 @72 00

STEEL.—Duty: Bars and ingots, valued at 7 cents ₱ lb or under, 2½ cents; over 7 cents and not above 11, 3 cents ₱ lb; over 11 cents, 2½ cents ₱ lb, and 10 ₱ cent ad val. (Store prices.)

English Cast (2d and 1st quality) ₱ lb	— 15 @— 18
English Spring (2d and 1st quality)	— 7 @— 12
English Blister (2d and 1st quality)	— 10 @— 17
English Machinery	— 11½@— 14
English German (2d and 1st quality)	— 13 @— 15
American Blister "Black Diamond"	— — @— 12
American, Cast, Tool do.	— — @— 18
American, Spring, do.	— 9 @— 11
American Machinery, do.	— — @— 12
American German, do.	— 9 @— 12

COPPER.—Duty: Pig, Bar, and Ingot, 5; old Copper 20 cents ₱ lb; Manufactured, 45 per cent. ad val.

	All Cash.
Copper, New Sheathing, ₱ lb	— @— 30
Copper Bolts	— @— 30
Copper Braziers, 16oz. and over	— @— 30
Copper Nails	35 @— 36
Copper, Old Sheathing, &c., clean	— @— 17
Copper, Chili Pig	— @— —
Copper, American Ingot	19¾@— 20½
Yellow Metal, New Sheating	— @— 22
Yellow Metal Bolts	24 @— —
Yellow Metal Nails	— @— 22

LEAD.—Duty: Pig, $2 ₱ 100 lbs.; old Lead, 1½ cents ₱ lb; Pipe and Sheet, 2½ cents ₱ lb.

Galena, ₱ 100 lbs	$— — @— —
Spanish (gold)	6 20 @6 25
German, do.	6 20 @6 40
English, do.	6 20 @6 45
Bar (net)	7 70 @— —
Pipe and Sheet (net)	7 70 @— —

TIN.—Duty: Pig, Bars, and Blocks, 15 ₱ cent. ad val.; Plate and Sheets and Terne Plates, 25 ₱ cent. ad val.

	Gold ₱ lb.
Banca	— @39½
Straits	— @38
English	— @35½

PLATES.

Fair to Good Brands.	*Gold.*	*Currency.*
I. C. Charcoal, ₱ box	$8 75 @9 —	$10 00 @10 50
I. C. Coke	7 — @7 75	8 25 @ 9 25
Coke Terne	6 — @6 25	7 25 @ 7 75
Charcoal Terne	7 75 @8 25	9 — @ 9 50

SPELTER.—Duty: In Pigs, Bars, and Plates, $1 50 ₱ 100

	Gold.
Plates, Foreign ₱ 100 lbs.	$5 85 @6 25
Plates, Domestic ₱ lb.	7 @— 11½

REMARKS.

IRON.—The demand for Scotch Pig has been rather moderate, but the supply is small, and prices are maintained. There has been a slight advance on the other side, but rates here are not as yet affected; the sales are 150 tons Eglinton at $32 50 ex-ship, and 200 do. Glengarnock, $34 50@ 35 from yard. American remains inactive, and prices are irregular. There is an active inquiry for both old and new Rails, and full prices are obtained on all offering—the sales are 2,000@3,000 tons new English at $60 gold, and 350 do. old Double-headed at $45 currency. Refined bar from store continues dull at former quotations, though all the mills are said to be firmer—$75 is asked, delivered in Philadelphia. We note a sale of 1,000 packs Russia Sheet, on private terms. The product of Anthracite Pig Iron in the United States in 1869 was 971,150 tons, of which Massachusetts produced 4,206 tons; New York, 210,855 tons; New Jersey, 54,201 tons; Pennsylvania, 692,739 tons; Maryland, 9,155 tons.

LEAD.—Pig is quite dull, and we hear of none but small jobbing sales at previous prices. Bar, Pipe and Sheet are steady at $7 70 per 100 lbs., net cash.

COPPER.—The manufactures of Copper and Yellow Metal are steady at our quoted rates. Ingot has been active, and the business is large; the bulk of the purchases have been on speculation; the transactions embrace about three millions of pounds, chiefly of Lake Superior, for August to November delivery, part, if not all, at 20¾@21c.; for immediate delivery, 20¾@20½c. cash; and Tennessee, 20½c. the market closing quietly at 20½c. for Lake and 20¼c. for Baltimore. The Lake companies have now sold their stocks up quite closely, and ask 21c.

TIN.—There has been no business in Pig, and we quote nominally as before, say 38c. for Straits, 35½c. for English, and 39½c. for Banca, all gold. Plates are also very quiet, and we have only to notice sales of 800 boxes Charcoal Tin at $8 75@$9 for I C, and 2,000 do., $8 62½, gold.

SPELTER.—Foreign is without demand, and our quotation of 5¾@6¼c., gold, is entirely nominal; 10 tons American Zinc Works sold at 8@8¼c., currency.

ZINC.—Sheet from store continues quiet, the Fall trade not having yet opened; 100 casks Mosselmann sold for arrival at 8¼c. less 4 per cent. gold.

American Oxide Zinc, 6½@7c.; French do. do. 9@9¼c.

MANGANESE—4@4½c.

Mining Stocks.

NEW YORK, June 30, 1870.

Business at the Mining Board is dull, and prices in many instances have receded. The hot weather is undoubtedly the cause of the apathy that exists in this as well as in other circles of trade. Consolidated Gregory is now quoted at $1 10; Grass Valley sold in lots of 500 shares yesterday at 40c.; and Central at 27c. Elsewhere will be found the quotations of the other Stocks dealt in at the Board.

Petroleum Stocks continue quite weak, and prices have receded in some cases since our last. Two hundred shares of Rynd Farm are quoted by the Board as sold at 30c.

	Bid.	*Asked*
Bennehoff	35	—
Bergen Coal and Oil	40	50
Bliven Oil	40	1 00
Brevoort	1 05	—
Buchanan Farm	45	50
Central	63	68
Home Petroleum	3 00	4 50
National	25	—
N. Y. & Alleghany	2 00	—
Northern Light	—	—
Pithole Creek	1 30	1 50
Phillips	15	—
Rathbone	25	40
Rynd Farm	30	33
Second National	—	—
Clinton	1 00	—
Blood Farm	50	1 00
United Petroleum Farms	20	—
United States	60	80

San Francisco Stock Market.

A telegram from San Francisco, dated June 28, quotes Comstock shares at still lower figures. This break in prices is undoubtedly due to the recent heavy assessments that have been levied by nearly all the companies. It is rapidly becoming plain, even to the most bitter enemies of the Sutro Tunnel, that from it alone can the stockholders expect any permanent relief from the calls that are constantly made upon them for more funds to keep the mines open. Quotations are as follows:

Savage	38	Gould & Curry	60
Yellow Jacket	42	Belcher	7½
Kentucky	30	Imperial	33
Chollar Potosi	29½	Amador	2 20

The Slate Trade.

NEW YORK, June 23, 1870.

[Corrected weekly.]

PRICES OF ROOFING SLATE.

(A "square" represents 100 superficial feet.)

Vermont purple, 1st quality, per square	$9 50@10 50
" green, 1st " "	9 50@10 50
" red, 1st " "	15 00@16 00
" variegated, "	8 5½@ 9 50
Pa. b'k and d'k blue, 1st qual., "	7 00@ 8 00

SHIPMENTS OF SLATE OVER THE LEHIGH VALLEY, AND LEHIGH AND SUSQUEHANNA R. R., AND THE LEHIGH CANAL:

For the week ending June 25, 1870.

LEHIGH VALLEY R. R.

ROOFING SLATE.

Jones & Williams	175 squares.
Lehigh Slate Co	70 "
Saylor & Morgan	140 "
Kuntz & Woodring	70 "
Girard Slate Co	— "
D. Thomas	175 "
Blue Mountain Slate Co	— "
Locke Slate Co	35 "
American "	— "
D. Williams & Co	70 "
Keystone Slate Co	35 "
Hope " "	35 "
Star " "	— "
Columbia " "	— "
Jones & Town	35 "
Total	840 "

SCHOOL SLATES.

D. Williams	— cases.
Lehigh Slate Co	— "
A. W. Lerch	180 "
Locke Slate Co	— "
Total	180

MANTELS.

Yerkes & Martin	28 cases.
Lehigh Slate Co	18 "
Total	46 "

LEHIGH AND SUSQUEHANNA R. R.

ROOFING SLATE.

Eagle Slate Co	70 squares.
Continental	70 "
Thos. W. Parry	— "
Twin City Slate Co	35 "
J. H. Walp	35 "
J. M. Coffin & Co	35 "
Lehigh River Slate Co	— "
William Chapman	— "
Mauch Chunk Slate Co	10 "
New York and Penn. Slate Co	35 "
Philadelphia	35 "
Total	325 "

LEHIGH CANAL.

ROOFING SLATE.

Heimbach Slate Co	— squares.

	Week.	Previously.	Total for Year.
L. and S. R. R.	345	2,774	3,119
L. V. R. R.	840	7,745	8,585
Lehigh Canal	—	762	762
Total	1,185	11,281	12,466

Baker's Cat—A California Story.

BY MARK TWAIN.

WHENEVER Dick Baker, of Deadhorse Gulch, was out of luck and a little down-hearted, he would fall to mourning over the loss of a wonderful cat he used to own (for where women and children are not, men of kindly impulses take up with pets, for they must love something), and he always spoke of the strange sagacity of that cat with the air of a man who believed in his secret heart that there was a something human about it—may be even supernatural.

I heard him talking about this animal once. He said:

Gentlemen, I used to have a cat here by the name of Tom Quartz, which you'd a took an interest in I reckon—most anybody would. I had him eight years, and he was the remarkablest cat I ever see. He was a large grey one of the Tom specie, and he had more hard natural sense than any man in this camp, and a power of dignity, he would'nt let the gov'ner of California be familiar with him. He never ketched a rat in his life, 'peared to be above it. He never cared for anything but mining. He know'd more about mining, that cat did, than any man I ever see. You couldn't tell him anything about placer diggings, and as for pocket mining, he was just born for it. He would dig out after me and Jim when we went over the hills prospecting, and he would trot along behind us for as much as five miles if we went so far. And he had the best judgment about mining ground; why, you never see anything like it. When we went to work he'd scatter a glance around, and if he didn't think much of the indications, he would give a look as much as to say, "Well, gentlemen, you'll have to excuse me," and without another word he'd hyste his nose in the air and shove for home. But if the ground suited him he'd lay low and keep dark till the first pan was washed, and then he would sidle up and take a look, and if there was about six or seven grains of gold he was satisfied, he didn't want any better prospect than that, and then he'd lay down on our coats and snore like a steamboat till we'd strike the pocket, and then get up and superintend the work.

Well, by the bye, up comes the quartz excitement. And everybody was into it, everybody was picking and blasting instead of shovelling dirt on the hill-side—everybody was putting down a shaft instead of scraping the surface. Nothing would do Jim but we must tackle the ledges, too, and so we did. We commenced putting down a shaft, and Tom Quartz he begin to wonder what in the dickens it was all about. He hadn't seen any mining like that before, and he was all upset, as you may say; he couldn't come to a right understanding of it no how; it was too many for him. He was down on it, you bet—he was down on it powerful, and always appeared to consider it the cussedest foolishness out. But that cat, you know, he was always agin new-fangled arrangements—he never could abide 'em. You know how it is with old habits. But by and by Tom Quartz got reconciled a little, though he could never altogether understand that eternal sinking of a shaft and never panning out anything. At last he got to coming down hisself, to try to cypher it out. And when he got the blues, and felt kinder scuffy, aggravated, and disgusted—knowing that the bill was running up all the time and we wan't making a cent, he would curl up on a gunny sack and go to sleep. Well, one day when the shaft was down about eight foot, the rock got so hard that we had to blast. the first blasting we had ever done since Tom Quartz was born. And then we lit the fuse and clumb out, and got off about fifty yards, and forgot and left Tom Quartz on the gunny sack asleep. In about a minute we seen a puff of smoke bust out of the hole, and then everything let go with an awful crash, and just about four million tons of rock and dirt and smoke and splinters, shot up about a mile and a half into the air, and by George, right in the midst of it was old Tom Quartz, going end over end, snorting and sneezing, and a clawing and a reaching after things like all possessed. But it wan't no use, you know, it wan't no use. And that was the last we seen of him for about two minutes and a half, and then, all of a sudden, it begin to rain rocks and rubbish, and directly he came down ker-whop about ten feet from where we stood. Well, I reckon he was about the orniest-looking beast you ever seen. One ear set back on his neck, and his tail was all stove up, and his eye-winkers was all singed off, and he was all blacked up with powder and smoke, and all sloppy with mud and slush from one end to the other. Well, sir, it wan't no use to apologize—we couldn't say a word. He took a sort of a disgusted look at hisself, and then he looked at us—and it was just the same as if he had said: "Gents, maybe you think it's smart to take advantage of a cat that ain't had experience in quartz mining, but I think different." And he turned upon his heel and marched off home without ever saying another word.

This was jest his style. And maybe you won't believe it, but after that you never see a cat so prejudiced against quartz mining as what he was. And, by and by, when he did go to going down into the shaft again, you'd been astonished at his sagacity. The minute we'd touch off a blast, and the fuze begin to sizzle, he'd give a look as much as to say: "Well, I'll get you to excuse me," and it was surprising the way he'd shin it out of the hole and climb a tree.

Sagacity? It ain't no name for it. 'Twas inspiration!

I said: "Well, Mr. Baker, his prejudice against quartz mining was remarkable, considering how he came by it. Could you ever cure him of it?"

"Cure him! No! When Tom Quartz was sot once he was always sot—and you might a blowed him up as much as three million times, and you'd never brake him of his cussed prejudice against quartz mining."

The affection and the pride that lit up Baker's face when he delivered this tribute to the firmness of his humble friend of other days, will always have a vivid memory with me.

Copper and Other Minerals.

IN the year 1869, 42,569 tons of British copper were exported from the United Kingdom—12,116 tons unwrought in bricks, pigs, etc.; 28,875 tons sheets, nails, etc.; 735 tons coin; 64 tons wire; and 779 tons wrought copper of other sorts. There is a large export to India, and a considerable quantity goes to European countries. The imports of foreign copper into the United Kingdom in 1869 included 72,190 tons of ore, 38,769 tons of regulus, 6,666 tons unwrought in bricks, pigs, etc. (and 2,560 tons were exported); 24,794 tons part wrought—bars, rods, ingots, etc., hammered or raised (and 9,527 tons were exported); 216 tons plates and sheets, 13,508 tons of copper manufactures and copper plates, and 2,637 tons were exported. The exports of tin from the United Kingdom in 1869 amounted to 5,082 tons British, and 1,112 tons foreign; 1,141 tons of British tin were exported to the United States. The imports comprised 5,442 tons of tin, and 533 tons of tin ore and regulus, the Straits settlements supplying 3,540 tons of tin. The exports of British zinc, or spelter, in 1869 amounted to 10,145 tons, sent chiefly to India and France, and 280 tons of zinc ore; the export of foreign zinc amounted to 3,002 tons. The import comprised 30,938 tons of zinc, 41,736 tons of ore of zinc, and 1,778 tons of oxide of zinc. The exports of British lead in 1869 comprised 40,242 tons pig, 6,254 tons rolled and sheet, 1,869 tons piping and tubing, 3,323 tons shot, 879 tons litharge, 3,300 tons red lead, 5,790 tons white lead. A large portion of the pig export goes to China. The year's import, chiefly from Spain, Sardinia, and Greece, comprised 52,683 tons lead, pig, and sheet; 11,874 tons lead ore, 89 tons red lead, 1,429 tons of white lead. The above returns show, generally, an increase in the exports of British minerals over the quantity in the preceding year.—*Mining Journal, June* 4, 1870.

Tin In Australia.

IT has long been known (says the local journal) that quantities of stream tin were to be found in Clear Creek, about two miles north of El Dorado, but it has never been prospected to any extent until Messrs. RIDDLE & AITKEN spent some time in examining the locality. They were fortunate enough to find a payable run of stream tin all along the bed of the creek. A lease has been applied for and the ground surveyed. Another claim has been pegged off above this claim, taking in the whole source of the creek, and payable ground has been found there also. We may soon be in a position to report the finding of a tin lode, as it is evident that the creek run must have been fed from some lode or reef.—*Mining Record of Victoria.*

Gold Refining by Chlorine Gas.

Read before the Royal Society of Victoria, by F. B. MILLER, F. C. S., Assayer in the Sydney Branch of the Royal Mint.

THERE is no recorded instance of gold having been found in an absolutely pure state. Every natural alloy of gold (or native gold, as it is called by mineralogists,) contains more or less silver; and in almost all bullion resulting from the melting of Australian alluvial gold, the portion that is not gold consists chiefly of silver, with only a very small proportion of foreign metals, usually copper and iron, with occasionally a little lead or antimony, and sometimes a trace of tin, iridium, etc. This, however, though true generally, is not always the case with gold obtained from quartz veins by amalgamation, as the mercury occasionally reduces and takes up other metals, as well as the gold, which appear in the bullion on melting. The accompanying table will give some idea of the proportion of the precious metals contained in the gold from the various districts of New South Wales, after melting. It will be seen that the most argentiferous is that from Boonoo Boonoo, in the north, containing as much as 34 per cent. of silver. This approaches, in composition, the gold from the productive Thames district of New Zealand; while the gold from Nerrigundah, in the south, only contains 1.5 per cent. of silver, the remaining 98½ per cent. being gold with a trace of copper.

TABLE SHOWING THE PROPORTION OF GOLD AND SILVER, IN CHARACTERISTIC SAMPLES OF GOLD-DUST, FROM VARIOUS LOCALITIES IN NEW SOUTH WALES (AFTER MELTING).

	LOCALITY.	GOLD in 1,000 parts.		SILVER in 1,000 parts.
Northern.	Boonoo Boonoo	654 to 695	....	337 to 298
	Fairfield	872	....	121
	Timbarra	708 to 898	....	280 to 97
	Peel River	929	....	67
	Rocky River	934 to 962	....	61 to 33
	Nundle	923 to 937	....	66 to 63
Western.	Bathurst	827 to 903	....	164 to 92
	Sofala	929 to 933	....	66 to 63
	Tuena	943	....	54
	Ophir	915	....	82
	Tambaroora	943 to 954	....	54 to 42
	Turon	918 to 928	....	78 to 68
	Hargraves	915	....	83
	Windeyer	946 to 959	....	53 to 37
Southern.	Burangong	948	....	48
	Adelong	946 to 951	....	52 to 45½
	Braidwood	928 to 934	....	67 to 62
	Emu Creek	971	....	27
	Delegate	971	....	27
	Nerigundah	983	....	15

An interesting, and as yet unanswered question, here arises: Is this argentiferous character in any way connected with the geological structure of the district?

It is a fact, and certainly a very curious one, whether it arises from accidental causes, or whether it may hereafter be traced to peculiarity in the rocks whence the gold of the different districts is derived, that its quality or fineness deteriorates the farther north we go; in other words, it contains more silver and less gold.

Thus, the average fineness of Victorian gold is about 23 carats—that is to say, it contains about 96 per cent. of gold and 3½ of silver, with a ½ per cent. of base metals; while, on passing north, we find the average fineness of New South Wales gold to be only 22 carats 1⅞ grain, or to contain 93½ per cent. of gold and 6 per cent. of silver. On going still farther north, to the colony of Queensland, the average fineness is little more than 21 carats, (considerably below standard), or it contains 87¼ per cent. of gold and 12 per cent. of silver; that from Maryborough containing as much as 14 per cent. of silver and only 85 per cent. of gold.

These are averages only. It is not to be supposed that there is a regular and consecutive diminution in fineness with every degree of latitude we go north. There are exceptional localities in the north of this colony, where the gold found is of a high degree of purity, as at Rocky River, where it is over 23 carats fine, or 96 per cent.

Possibly, at a future time, our geologists may be able to throw some light on these curious facts, and the exceptional cases may then even help in explaining the apparently general rule. The point, however, of principal interest, as far as regards the subject of this paper, consists in the fact that, as the alloy obtained by the gold miner is poorer in gold, it is proportionally richer in silver.

According to the published returns, 6,820,198 ounces of gold have been received for coinage in the Sydney Mint between its establishment, in May, 1855, and December 31, 1868. The average assay of this quantity would be about 943; in other words, it contained 94⅓ per cent. of gold, 5 per cent. of silver, and ⅔ per cent. of base metals. Allowing an average loss of 2 per cent. in melting the gold dust, there would remain, after smelting, 6,683,795 ounces of gold bullion; and as the silver it contained amounted to 5 per cent. of this quantity, the gross amount of silver in the gold received for coinage was 334,190 ounces; being at the rate of 24,750 ounces per annum.

The average proportional quantity of silver contained in the gold arriving in Sydney, is at present very much greater than that given above, owing to the large amount of silvery gold now being found, especially in the neighboring colony of Queensland, and for the year 1868 was not less than 36,000 ounces (£9,150), and was probably (including that in the gold shipped direct as bullion by the banks) nearer 42,000 ounces. Most of the silver thus naturally present in the gold has hitherto been lost to the colony, owing to the expense, in Sydney, of the acids, etc., necessary for its extraction by any of the usual methods of refining, which left little, if any, margin of profit on the operation. It, therefore, seemed desirable that some easy and economical process should be contrived for refining, in Australia, without the aid of costly plant and chemicals.

Twelve months ago, a paper of mine, describing a new process for refining and toughening gold by means of chlorine gas, was read before the Chemical Society, London. As, since the publication of that paper, the method of refining therein proposed has been successfully brought into practical operation on a large scale, both here and in New Zealand, and there is a probability that its adoption will, before long, become more general, I lay before the members of this society a somewhat detailed account of the process, and some of its more striking results. I shall, as far as possible, avoid giving the details of the preliminary experiments which lead to the practical application of the process, and which have already been published in the *Journal of the Chemical Society;* but, in order to render myself intelligible, some repetition of what is therein contained will be necessary.

Most people at all interested in the matter are aware that the ordinary method of separating silver from natural alloys of that metal and gold, is a complicated and expensive process, and that the end is attained by melting the gold with at least 2½ times its own weight of silver, and then again separating, by the action of acids, the silver thus added, and also, at the same time, the small quantity originally contained in the gold, thus leaving, as a residue, fine gold assaying from 990 to 993; the *rationale* of the operation being this: If the natural alloy were simply placed in the acid, the very large excess of gold in the alloy would completely protect the silver it contained from the action of the acid; but if the gold is melted with a large excess of silver, so that the silver greatly preponderates over the gold in the alloy treated, then the acid is able to exert its solvent action not only on the silver thus added, but also on that originally contained in the gold. To arrive at this end, a complicated and very costly plant is required, besides large quantities of expensive acids; and several days are occupied in the operation. It is evident then that, if all this complicated process can be avoided, and the silver simply and completely separated in one operation at the time the gold is being melted, a very great saving of time, of material, of plant, and of the interest involved in all these, will be effected.

Such an end is attained in the plan now being adopted for effecting this operation. It is well known that chlorine readily enters into combination with almost every known metal, the action, in some cases, being so violent as to be attended with vivid combustion. Many metals, such as lead, tin, zinc, and antimony, when introduced into this gas, even at ordinary temperatures, combine with it, forming highly-volatile chlorides. The two latter, if in a state of fine division, burst into flame on being placed in an atmosphere of chlorine. Copper also exhibits spontaneous combustion under similar circumstances, but the resulting chloride formed is only slightly volatile. Silver, immersed in chlorine gas at ordinary temperatures, slowly unites with it, forming chloride of silver; but if the gas be passed over it while red-hot, the action is much more energetic, the compound formed being more volatile than the chloride of copper, but much less so than those of lead, tin, zinc, or antimony.

The method of refining now to be described is based upon these facts: It consists simply in passing a current of chlorine gas through the gold *while in a melted state*, which is easily done by thrusting into the molten metal a small clay tube connected with a stone-ware vessel in which chlorine is generated. The chlorine, on coming in contact with the silver in the molten alloy, at once combines with it, forming chloride of silver, which, being of less specific gravity, rises to the surface of the melted gold, while this latter remains in a purified condition beneath. Chloride of silver has always been considered a somewhat volatile substance, and under circumstances, such as those here described, it was naturally supposed that it would either be sublimed in the flue or escape entirely up the chimney; but in practice it is found that the volatility of the chloride is not nearly so great as might have been anticipated, and that, if its surface is coated with a layer of fused borax, it may be kept melted at a high temperature, without any very material loss. The furnace required for the operation is the ordinary twelve-inch square gold-melting furnace, the principal points to attend to in its construction being: 1. That the flue should be as near the top as possible, so as to allow of the crucible standing high up in it without being cooled by the draught; and, 2. That the furnace itself should not be too deep, so that, when the pot is placed in the fire, the bottom of it may not be more than three inches above the bars. The covering of the furnace should consist of two fire-tiles, 7½ inches wide and 15 inches long, one of which should have a long slot or hole in its centre, for the clay chlorine pipes (which I shall describe presently,) to pass through. An iron cover will not answer, as it soon becomes much too hot for convenient working.

The crucibles in which the refinage is performed should be French white fluxing-pots, (creusets de Paris, made by DE RUELLE, late PAYEN, Paris); ordinary black-lead pots will not answer, owing to the reducing action they exert on the compounds formed. To prevent the infiltration of the very fluid chloride of silver into the pores of the clay pots, (which would otherwise occur, and necessarily entail loss,) they are prepared by filling them with a boiling saturated solution of borax in water, which is allowed to stand in them for ten minutes, and is then poured off, the crucibles being afterwards set aside to dry; the borax forms glaze on the inner surface of the crucibles when they become hot in the furnace.

When used for refining, these French clay crucibles are placed within black-lead pots, as a precaution against loss, should the former crack, which, however, seldom happens. The crucibles are covered with loosely-fitting lids, with the requisite holes bored through them for the passage of the clay chlorine pipes, etc. Ordinary clay tobacco-pipe stems, from 17 to 22 inches long, have been found to answer well for the purpose of passing the chlorine gas through the melted gold. Of late, a pipe made in London to order, ½ inch in diameter, 22 inches long, and 3-16 inches bore, has been found to answer all requirements. The chlorine generators should consist of the best glazed stone-ware acid jars, capable of holding from 10 to 15 gallons, and furnished with two necks. One of these openings should be stopped with a sound cork (or vulcanized India-rubber plug, if obtainable,) through which should pass tightly two glass tubes—the eduction tube and the safety or pressure tube, the length of the latter being a few inches, and the former 8 or 10 feet, spliced, where necessary, by means of vulcanized India-rubber tubing. The other opening, intended for introducing the oxide of manganese, etc., should be closed with a leaden plug, covered with a short piece of India-rubber tube by way of a washer, and well secured.

Each generator should be charged with a draining layer of small quartz pebbles, down nearly to the bottom of which the pressure tube should extend. On this layer should be placed from 70 to 100 pounds weight of binoxide of mangenese, in grains about ¼-inch cube, sifted from powder; this quantity will be sufficient to effect many refining operations, and will obviate the necessity of repeated dismantling of the apparatus. Each generator should be suspended to about half its height in a galvanized iron water-bath.

The chlorine gas is produced, when required, by pouring common hydrochloric acid (sp. gr. 1.15) down the safety-tube, the apparatus being warmed by means of gas burners beneath the water-baths. The gas is conveyed from the generators by means of a leaden pipe, fitted with branches, to supply the several furnaces, all intermediate connections being formed by means of vulcanized India-rubber tubing, which, if screened from the direct radiation from the fire, stands the heat well, even immediately over the furnaces. All joints between the various pipes and India-rubber tubes are easily secured, and rendered perfectly gas-tight, with a cement consisting of a thin solution of India-rubber in chloroform.

Screw compression-clamps on the India-rubber tubes give the means of regulating the supply of gas as required, and enable the operator to shut it off entirely as soon as the refining is over. The chlorine then, having no means of escape, accumulates in the generator, and soon forces all the acid up the safety-tube into a vessel placed above to receive it, and the acid no longer acting on the oxide of manganese, the supply of gas of course ceases.

These generators are very convenient and manageable, and it is questionable whether a gas-holder for the chlorine (even if the practical difficulties in its use could be overcome,) would be at all preferable. Two such generators as are here described, and three ordinary gold-melting furnaces, have been found capable of refining daily about 2,000 ounces of gold, containing about 10 per cent. of silver, between 9 A. M. and 2 P. M.

[TO BE CONTINUED.]

Coating Copper and Brass with Zinc.

PROFESSOR BOETTGER, of Frankfort-on-the-Maine, has lately made experiments for the purpose of imparting to sheet copper the appearance of tombac, or brass, in the so-called humid way. The process has been practised in the dry way by means of zinc vapors, in the manufacture of the so-called Lyon gold, but is not quite satisfactory. During these experiments, he discovered a simple method of coating copper wire, sheet brass, wire gauze of these metals, pins, etc., with a shining, firmly-fixed layer of zinc. From the behavior of the pasteboard sheets, saturated with a solution of sal-ammoniac, towards sheet copper and sheet zinc, as used in the construction of the voltaic pile of the older kind, he concluded that sal-ammoniac was the best agent for the coating of copper and brass surfaces with zinc. He prepared finely-granulated zinc by pouring fuzed zinc into a previously well-heated mortar, and rubbing into the liquid metal energetically with the iron pestle until it solidified. On this a saturated solution of sal-ammoniac was poured in a porcelain vessel, and heated to the boiling point. The articles to be covered with zinc, the surfaces of which had been previously well cleaned by dilute muriatic acid, were then introduced into the solution, and, the boiling being continued, the objects were covered in a few minutes with a bright coat of zinc, which could only with great difficulty be removed by rubbing. Instead of granulated zinc, obtained as above described, the so-called zinc-gray (metallic zinc in the form of dust,) can also be used.

The coating with zinc is here effected by means of a simple hydro-electric process, in which the chloride of zinc and ammonium, produced by the boiling of zinc-dust, is decomposed by the presence of the metallic zinc-chips and the sheet copper. The chlorine, liberated by the reaction of sal-ammoniac on zinc, from a part of the sal-ammoniac, combines with zinc, while the ammonium, formerly combined with the chlorine, escapes in the form of gases; an undecomposed part of the chloride of ammonium combines with the chloride of zinc to chloride of zinc and ammonium, a double salt, which is easily soluble and easily decomposed. If, therefore, zinc-chips are in the solution, which, at the same time, are in immediate contact with the electro-negative copper, the salt is decomposed, and the reduced metallic zinc adheres firmly to the negative copper. Tartrate of potassa, used instead of the chloride of ammonium, does not exhibit a similar behavior, although such might be supposed, since tartrate of oxide of zinc and potassa is formed easily in treating zinc with tartrate of potassa, and since this salt is also easily soluble.—*Deutsche Industrie Zeitung.*

Ancient Salt Mines in India.

DURING his recent Indian tour, the Viceroy visited the ancient salt mines of Pin Dadun Khan, which are interesting as dating from the days of Alexander, and as being worked, so says tradition, by the actual descendants of the original miners. Of the nine mines, one alone is really worth a visit, and this is the largest and oldest of the whole. It contains a huge circular hall, some ninety feet across and forty in height, which, lighted up by hundreds of oil lamps, and roofed, walled and floored with salt, is a sight of peculiar beauty. The supply seems simply inexhaustible, and with improved appliances for excavation and transit would largely increase in value.—*Times of India.*

THE ENGINEERING AND MINING JOURNAL.

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Zinc Coating for Iron Vessels.

THE importance of some cheap and effective preventive of the fouling of the bottoms of iron ships has long been felt in England, and is sufficiently clear without any elucidation from us.

The difficulty of applying molten zinc arises from two causes. In the first place rolled iron is always covered with a thin skin or scale, which is hardened, and presents a different surface and composition of iron from the body of the plate. This presents invariably a difficulty to the adhesion of zinc. In the next place, in order that the union of the two metals shall be firm and good, the iron must have nearly or quite the temperature of molten zinc, which cannot be easily imparted to the plates after the ship is built, without in any way injuring it.

At a meeting of naval architects, held in London on the 8th of April last, Mr. CHARLES LAMPORT offered some original ideas upon the subject, which during the coming year he proposed to make the subject of research and experiment. Mr. GALLOWAY, in offering his assistance in conducting these experiments, naively remarked, that if they were successful in preventing—as Sir JOHN HAY has styled it—the destruction of Her Majesty's Navy, he hoped that the Admiralty would not forget them.

The process proposed by Mr. LAMPORT consists in removing the skin alluded to by means of sulphuric acid applied to the sides of the ship by means of a frame of laths, and then applying the ordinary flux.

We continue the description in his own words: Over the sides of the ship I propose to suspend a bath, with so much of a furnace attached as will maintain the zinc in a fluid state, and, of course, maintain the temperature at a sufficient height to do so. This bath being in contact with the side of the ship to a certain extent, the plate against which it is placed will become of a temperature, I think, quite sufficient to allow of adhesion, if the scale is taken off. Intermediately between the bath and the ship, I propose to have what I may term a mould, which would consist of a steel plate something like a quarter of an inch thick, rolled cold, and a very fine skin put upon it, so that the zinc should have no chance of attaching to it. Then round the edges of this there would be a thin boundary or edging of metal, of the thickness of the plate which I intend to cast on the side of the ship. Then would come the suspension of the furnace over the ship's side, so that the metal mould, of which I have already spoken, should come exactly over, and the outside exactly accord with the wooden framework which I have just mentioned. When the steel plate had sufficient elasticity to allow screws to adjust it tightly to the side of the ship, the upper side being open, I should then propose to pour over the zinc bath the fluid metal into this mould, allowing it to remain there in contact, and with a free circulation of cold between the mass of the zinc metal in the bath, and the thin film which is to form the sheet against the side of the ship. I conceive that by so doing I might in a short time bring up the plate to which the bath is attached, to a sufficient degree of heat to conform to all the conditions necessary to perform the ordinary process of what is called galvanizing, which is, more properly speaking, zincing. A zinc plate on the side of a ship has a different ratio, and different condition of contraction and expansion under heat from the iron plates of a ship. Provision, therefore, should be made in some degree for buckling, imperceptibly it may be, but quite sufficient to prevent the perfect adhesion of a thick zinc plate over the whole surface of the iron plate which was to be attached, I therefore propose, supposing it were ten feet long, with a breadth of two feet, to depend more upon the horizontal bands for the attachment of the zinc, leaving the intermediate spaces unattached to the iron, but in close contact with it, allowing a sufficient space, if the construction were to vary, because the heat brought to bear on the side of a ship in a tropical climate is so great as to cause a troublesome difference of expansion, and that difference of expansion might be accommodated by the unattached portions between the bands. If my idea is a correct one, I should have attached to the side of a ship by the zincing process, a zinc plate with a number of bands, which practice only could prove to be sufficiently correct, without any injury to the iron, without any expense to the structure of the ship, and which might be renewed by a very easy process, which I need not now explain, when corrosion had taken place to such an extent as to make it necessary to resheath the ship.

Composition of Wootz Steel.

IN the *Industrie Zeitung* we find an analysis of this East-India steel, by Prof. RAMMELSBERG, of Berlin.

The Wootz or Bombay steel has been celebrated, from olden times, for its surpassing hardness, which has given it the first place for the manufacture of cutting instruments. According to several authorities, it is made by smelting a pure, sandy magnetic ore in small furnaces, by which means blooms weighing about 40 lbs. are made. These are hammered out, cut into pieces and smelted with chips of the *Cassia Auriculata*, an East-Indian plant, in a clay crucible with an air-tight cover. Twenty to twenty-four of the crucibles, each containing only a pound of material, are heated at once in a small blast-furnace, and in each crucible is found at the end of the operation a small smelted lump of cast-steel. It is said that only 12 per cent. of the iron contained in the ore is saved in this way. Wootz steel is therefore a cast-steel, which partially accounts for its good quality.

In 1819, FARADAY, in connection with STODARD, undertook an analysis of Wootz, which attracted considerable attention from the fact that they found aluminia as well as carbon and silicic acid. From this fact they concluded that silicon and aluminium imparted to the East-India steel its peculiar properties. They found 0.03 per cent. of silica and 0.7 per cent. of alumina, not in the solution of the steel in aqua regia, but in the black, carbonaceous residue, when subsequently heated to redness in a silver crucible with caustic alkalies. This manner of procedure, in the light of the present advancement of chemical science, is sufficient to place the accuracy of the result in doubt. KARSTEN, who accomplished so much in iron investigations, found only doubtful traces of aluminium. T. H. HENRY afterwards analysed a sample, the genuineness of which was doubted, and found

Graphite	0.312 per cent.
Combined Carbon	1.336 "
Silicon	0.044 "
Sulphur	0.175 "
Arsenic	0.036 "

but no aluminium.

The collection of the Royal *Gewerbe Akademie* in Berlin contains a sample of Wootz-steel, the genuineness of which is guaranteed by a certificate of the East-India Company. A portion of this bar was broken off and used by RAMMELSBERG for his investigations, of which he gave the following account to the Chemical Society of Berlin. The specific gravity is 7.822, instead of 7.728, as given by HENRY. It dissolves in hydrochloric acid, leaving only a very small white residue. It contains, therefore, no graphite. The solution in hydrochloric acid gave no trace of copper or arsenic when treated with sulphuretted hydrogen. For the determination of carbon, it was treated with water with the addition of bromine; the carbonaceous residue, when burned in oxygen, left likewise no trace of graphite.

Sulphur was determined by passing the gas generated by the solution in hydrochloric acid through a solution of chloride of silver in ammonia. The dark precipitate was oxydized by means of nitric acid, and after precipitating the silver, the sulphuric acid was precipitated as sulphate of baryta. The nitric acid solution was evaporated to dryness in a platinum vessel, the residue heated alternately in hydrochloric and hydrogen gas, and left, after driving off the sesqui-chloride of iron, a residue of silicic acid which disappeared by heating with fluoric acid. The WOOTZ contained no trace of aluminum.

The result of the analyses was

Carbon	0.867 per cent.
Silicon	0.136 "
Phosphorus	0.009 "
Sulphur	0.002 "

HENRY found altogether twice as much carbon, one-third of which was in the form of graphite. But inasmuch as he had softened the steel, in order to be able to get filings to burn with oxide of copper, it is possible that the softening may have given occasion for the formation of graphite, although KARSTEN is of the opinion that soft steel contains no graphite. RAMMELSBERG found three times as much silicon as HENRY, and one of ABEL's analyses shows that a great deal more may be contained in cast-steel. HENRY, futhermore, reports no phosphorus as present, but on the other hand gives arsenic, which is certainly not present at all. Finally, it is to be noted, that HENRY gives such an amount of sulphur, that the steel would be valueless; for, according to KARSTEN, wrought-iron containing 0.034 per cent, of sulphur is in the highest degree red-short, and 0.01 per cent. is the boundary for the use of iron.

A great many analyses of iron, give, like HENRY's, altogether too high a percentage of sulphur, in consequence of the method pursued in its determination. Is there, after all, any such thing as an aluminum steel? FARADAY heated steel with coal dust, and the resulting dark gray, foliated product (cast iron) he heated to a high temperature with pure alumina. He produced a white, fine grained, very brittle mass, which contained, according to his analysis, 3.4 per cent of aluminum. When from six to twelve per cent. of this was smelted with good steel, the product was a steel, possessing the excellent characteristics of the WOOTZ. The reduction of the alumina, under the circumstances, was very remarkable, and the experiment should be repeated, with the direct use of aluminum, which FARADAY could not obtain. The experiment of producing aluminum steel has often been tried, but the samples that RAMMELSBERG has received as such, have always failed to show the presence of aluminum.

The Lake Superior Mines.

IT will be remembered that we took the liberty of warning our Lake Superior friends, some months ago, that the special legislation which they secured in the shape of a tariff on copper and copper ores would not materially improve their condition, while its effects on the copper-smelting establishments of the Atlantic States would be most unfortunate. It will be seen by our mining summary that many of the principal companies at Lake Superior are stopping work, and that by October not more than six will be running in the whole region. A large population will thus be thrown out of employment; and we fear it will be some time before the business of copper-mining will revive to anything like its former activity in that district. The fact is, copper can be made more cheaply from Tennessee, Vermont, California and South American ores; and while legislation may protect Lake Superior against foreign competition, the competition of more highly favored localities in this country will be inevitable and disastrous, unless an extraordinary increase of demand and price should take place.

We hope the skilled miners and others thus deprived of occupation will be able to find work in the prosperous iron-mining region back of Marquette. Probably they will never be able to carry matters there with so high a hand as they could and did repeatedly in the more remote part of the Peninsula, where they had to deal with distant, ignorant and speculative owners. Extortionate wages have repeatedly been paid within the last eight or ten years, to the common miners of the Lake Superior copper regions. We remember when companies endeavoring to develop new properties in the Ontonagon district, while they paid a thousand dollars a year to their agents or superintendents, were forced to give teamsters and day-laborers ninety dollars a month and board—and could not be sure of keeping them at that price.

The present state of things is partly, no doubt, a legimate result of the speculative management on one hand, and the unreasonable and short-sighted extortion on the other, which characterized the flush times of Lake Superior; but, like many other retributions of history, it falls heaviest on innocent parties. The present stockholders of the companies are probably not the same who pocketed the large dividends or made money on the stock, in days gone by; and the hard-working miners now deprived of a living may not be the men who sucked the blood out of this industry when it was strongest and most flourishing.

Novel Use of Gas from an Oil Well.

WE condense from an exchange a letter concerning a novel use of the gas from an oil well in Venango county, Pennsylvania.

In 1866, about fifteen miles southeast of Oil City, a well was sunk to the depth of 850 feet to the third sand-rock, and a heavy mud-vein struck, in which the tools stuck fast, so that the proprietors have never succeeded in removing them. The tubing was partially withdrawn, when the rope broke; a portion of the tubing was lost, and operations were suspended. Immense volumes of gas were escaping from the well at the time, and afterwards became ignited, and continued to burn for some time. A new well was commenced in 1868, near the first one, and bored to the depth of 960 feet, which, if properly cased, would doubtless have proved very productive. So great was the pressure of gas in this new well that only within the past few weeks has it been possible to pump it to any advantage. The well now prospects well. The pumping engine is run by means of the pressure of the gas from the old well, conducted to the cylinder by means of a two-inch iron pipe. The writer of the letter referred to is of the opinion that any number of engines could be run by the gas from this well. This gas is extremely cold, and the whole affair is a remarkable exhibition of natural force.

The Ellershausen Process.

WE publish in the present number a discussion of the ELLERSHAUSEN process for malleable iron, from the pen of Dr. T. STERRY HUNT, which is quite new and highly important. It will be seen that Dr. HUNT pronounces the process a practical success, so far as the production of malleable iron is concerned, though not for the manufacture of steel. He seems to adopt the opinion of some iron-masters, who are now employing the method, that it is destined to general use, while it is not denied that in some cases experiments with it have resulted in more or less decided failures, ascribed partly to the jealousy of puddlers, and partly to the ignorance of the experimenters, concerning the true conditions of success. Dr. HUNT's elucidation of the chemical theory of the process is peculiarly clear and interesting.

Telegraphing.

THOSE who witnessed some experiments on the 15th of May, in the office of the Western Union Company, in this city, believe that the limit of the capacity of the telegraph wires is not yet known. A combination of circuits was formed, varying in length from three thousand to five thousand miles, through which Mr. R. C. DUNCAN, chief operator of the company in this city, and one of the most accomplished of the profession, sent messages with great ease and rapidity. The first circuit formed was from New Orleans, via New York, to Plaister Cove, Nova Scotia, the terminus of the Atlantic cable, a

distance of three thousand miles. The operators, thus widely separated, chatted together with perfect ease, the signals coming rapidly and with great distinctness. After a few moments' conversation, another circuit of still greater length was made up, and we are informed that it was the longest land circuit through which intelligible signals were ever sent. Nine repeaters were used, one each at Rome, Georgia, Lynchburgh, Virginia, New York City, Pittsburgh, two at Cincinnati, one each at St. Louis, Chicago and Memphis. The writing was returned to New Orleans almost as clearly as when leaving the office, having passed through eighteen States and over four thousand eight hundred miles of wire. The electric current traversed the distance in about three-quarters of a second. The writing was transmitted as rapidly as on ordinary short wire.—*New Orleans Times.*

The Ellershausen Process for Malleable Iron.

THE removal from cast iron of its carbon and silicon, and its conversion into malleable iron, is chiefly effected in two ways: of these the first consists in melting down the pig metal, before the blast, in an open fire known as a hearth-finery or bloomary, somewhat resembling the bloomary hearth used for the direct process of reduction in the United States. In the second method, the metal is melted and decarbonized in reverberatories, known as puddling-furnaces. In the puddling process the carbon of the iron is removed, partly by the oxygen of the air, and partly by that of the oxyd of iron, which, in the form of iron ore, is used for lining the sides of the furnace, or fettling, as it is called, for which purpose large quantities of magnetic and hematite ores are consumed.

In both of these processes the cast iron is melted, but there are two methods, which have long been known, in which the decarbonization of cast iron, and its conversion into malleable iron, are effected without fusion. In one of these, small objects of cast iron are imbedded in pulverized hematite ore, in carefully closed crucibles, and are then exposed for three or four days to a red heat; when, if the size of the castings is not too great, they are found to be decarbonized, and changed, throughout, into soft malleable iron. In this way are prepared the so-called malleable castings. Very similar to this, in principle is a process practiced in Wales some half a century or more since, and described by PERCY, after MUSHET (Metallurgy, p. 803). Granulated or shotted cast iron was mixed with a certain proportion of bloomary cinder, rich in oxyd of iron, and the mixture exposed for some hours, in covered crucibles, to a red heat. At the end of this time it was found that the grains of iron were decarbonized, and capable of being welded together; having been, in fact, converted into malleable iron by the action of the iron oxyd.

By another process, the use of the oxyd of iron is dispensed with, and the iron is kept at a red heat, in contact with the air. In TUNNER'S method, plates of cast iron, from one-half to three-fourths of an inch thick, are packed in boxes of quartz sand, so arranged as to permit the passage of air, and exposed to a glowing red heat for several weeks; at the end of which time the metal is found to be decarbonized, and converted into malleable iron. The impurities which form fusible slags, appear, in these methods of producing malleable iron, to be separated in liquid form; sweating out, as it were, from the pores of the iron.

With these facts in mind, we are prepared to understand the results obtained by Mr. ELLERSHAUSEN, which have given rise to the process bearing his name. In 1868, while making experiments on the production of steel, he endeavored to incorporate coarsely pulverized oxyd of iron with molten pig metal, with the intention of subsequently melting down the mixture, and thus obtaining cast steel, by a process essentially the same with that of WOOD and UCHATIUS.

He found, however, that the composite ingots of ore and pig metal, when heated on the hearth of a reverberatory furnace, did not fuse, but that the metal was rapidly decarbonized, and, with the separation of a considerable amount of liquid slag, converted with malleable iron, which could be taken at once to the squeezer, and rolled into bars of a quality superior to those produced by the method of puddling.

It might at first appear that, as in the production of malleable castings, the mingled oxyd of iron was the sole agent in thus decarbonizing and effecting the conversion of the metal, but subsequent experiments have shown that by reducing the proportion of ore much below that required, by theory, to effect the change; and even by replacing a portion of the ore by powdered charcoal, whose effect would seem to be the reverse of oxydizing and decarbonizing, as good results were obtained as before. In the pig-bloom, as the aggregate of pig-metal and ore is termed, the iron is much subdivided, being partly in grains, and partly enveloping the granules of iron ore; the whole forming a somewhat porous aggregate, which is pervious to air, and thus offers a great extent of surface to its oxydizing action, as well as to the action of the intermingled oxyd of iron. Where an admixture of charcoal is used, it would soon be destroyed by combustion, and by the action of the accompanying iron-oxyd, and the mass rendered still more permeable to the air; so that the finely-divided white cast iron of the pig-bloom becomes rapidly decarbonized under the joint influences of the oxygen of the air and that of the ore. The ore, being in part reduced to the metallic state by the carbon and silicon of the cast iron, tends to make the loss of iron less than in the puddling process. In this view, the ELLERSHAUSEN method unites the reactions of the process for malleable castings, and the WELSH process above described, where oxyds of iron are the decarbonizing agent, with that of TUNNER, in which the decarbonization is effected by the oxygen of the air.

If we suppose the oxygen of the mingled iron ore to be the sole decarbonizing and purifying agent, the reaction would be as follows: the carbon of the pig iron, with the oxyd of iron, would give rise to metallic iron and carbonic-oxyd gas; while the silicon, which the crude metal always contains, in variable quantities, would reduce another portion of the oxyd, liberating metallic iron, and forming silicic acid. This, in its turn, would unite with a portion of unreduced oxyd of iron, to form a fusible silicate or slag.

If we take the magnetic oxyd of iron, the reaction with carbon would be represented by

$$Fe_3O_4 + 4C = 3Fe + 4CO,$$

while with silicon we should have

$$Fe_3O_4 + Si = Fe + SiO_2, 2FeO.$$

The above equations lead to the following results for each unit of carbon and silicon in the pig iron:

1 carbon requires 4.83 magnetic oxyd, and gives iron 3.5, carbonic oxyd 2.33
1 silicon " 8.28 " " " " " 2.0, silicate of iron 9.28

Thus a pig iron holding, for example, 95.00 per cent. of iron, 4.00 per cent. of carbon, and 1.00 of silicon would require,

4 × 4.83 = 19.32 of magnetic oxyd.
1 × 8.28 = 8.28 " " "
27.60 " " "

and should yield 16 parts of reduced iron, and 7.28 of silicate of iron. In the case of some pig irons, which, in addition to 4.0 or 4.5 per cent of carbon, contain 2.0, or even 2.5 per cent. of silicon, the quantity of magnetic oxyd required, according to the above formulas, would be greatly increased. In the trials on a large scale, for the production of malleable iron by the ELLERSHAUSEN method, at Pittsburgh, Dr. OTTO WUTH made careful analyses of the pig metal, and the resulting products, both iron and slag. From these analyses it appears that when 100 parts of a metal, holding over 1.0 per cent. of silicon and 4.2 per cent. of carbon, were mixed with from 28 to 30 parts of magnetic or hematitic iron ore, and treated as above described, the silicon and nine-tenths of the carbon were removed, together with most of the sulphur and phosphorus. At the same time the resulting slag was much richer in iron than that obtained in puddling the same iron, or indeed, than most slags from the puddling-furnace. It contained an amount of iron equal to not less than 64.9 per cent. of metal, and but 8.95 per cent. of silica, while the saturated silicate of iron, whose formula is given above, contains but 54.9 per cent. of iron, and 29.4 per cent. of silicon. The highly basic slag from the ELLERSHAUSEN process, as analyzed by Dr. WUTH, has thus a composition corresponding to a mixture of about 30 per cent. of a saturated silicate of protoxyd of iron, (with small portions of lime, magnesia, and alumina,) and seventy per cent. of magnetic oxyd of iron.

From this it appears that a large part of the ore added to the pig metal is not consumed, but passes off in the slag; and it would seem that, in this case, the principal action of the oxyd of iron had been the removal of the oxidized silicon. Each unit of silicon furnishes by its oxydation an amount of silica which requires at least four units of iron, in the state of protoxyd, for its conversion into the ordinary fusible silicate of iron. All of this oxyd of iron, in the ordinary puddling process, except so far as furnished by the fettling, must be derived from the oxydation of the metal, and hence the great waste with highly siliciferous cast iron in the puddling-furnace. For such irons, therefore, the ELLERSHAUSEN process would seem to be especially adapted.

Were the conversion of the iron to take place according to the formulas already given, solely by the action of the oxyd of iron on the carbon and silicon of the pig metal, 100 parts of this, having the composition above assigned, should yield theoretically, supposing no subsequent loss of iron by oxydation, or otherwise, 111 parts of pure iron; since to the 95 parts present in the pig metal, would be added 16 parts reduced from the oxyd, by the carbon and silicon. In practice, however, the gain is much less than this, leading to the conclusion that a part of the carbon is oxydized by atmospheric oxygen, while much of the added iron-oxyd must escape unreduced, in the slags, as we have seen is really the case. According to Dr. WUTH, the result of the treatment of nearly four thousand tons of iron by the ELLERSHAUSEN method, as above described, with about 28 per cent. of oxyd of iron, showed a gain of not quite 5 per cent. on the weight of the pig iron employed.

These conclusions are confirmed by recent results of the iron works of Messrs. BURDEN, at Troy, New York, where the ELLEESHAUSEN process has been found to give satisfactory results, with 15 per cent. of magnetic iron ore, although the quality of the product was improved when twenty per cent of ore was used.

Analyses of the pig metal, the ore, and the products, in such trials will be most important as serving to shed farther light on this new process. Meanwhile the following suggestions with regard to it seem warranted by the facts before us: 1st. The ore used should be as free as possible from impurities. Silicious matters, by uniting directly with the oxyd of iron, occasion a large loss of ore; while lime, magnesia, and alumina-compounds, not only increase of the bulk of slag, but render it pasty and difficult to be removed from the iron. 2nd. The ore should be finely divided, inasmuch as more surface will thus be presented to the iron. In the working of the process at Pittsburgh, much of the ore added was in coarse grains, which escaping, dissolved in the slag, but otherwise unchanged, caused this to be, as we have seen, extremely rich in oxyd of iron. The coarse grains, it may be supposed, serve however to give to the aggregate that mechanical condition which is favorable to the proper working of the process, a result which would probably be equally well secured by the admixture of a portion of charcoal; an experiment, which I am informed, has already been successfully tried at Pittsburgh. The use of a greatly reduced proportion of finely divided and very pure ore, together with a portion of coarsely ground charcoal, would therefore seem to promise the best and most economical results with the ELLERSHAUSEN process. Rich hematite, free from silica, or magnetite, previously calcined, and if necessary, purified, after crushing, by the aid of a magnetic machine, should be tried. The magnetic portion of the fine iron sands from the lower St. Lawrence would probably yield excellent results in this process. Some experiments made at Pittsburgh, in which the purified iron-sand was used in place of the ordinary ores, are said to have given a superior quality of iron. The ores used in the trials which gave the products studied by Dr. WUTH, were, however, the magnetite of Lake Champlain, with some hematite from Missouri.

From what has been said, it will be evident that the supply of air in the furnace should be as abundant as in the process of puddling, and that a reducing or feebly oxydizing atmosphere therein, would either greatly modify the conditions of the ELLERSHAUSEN process, or lead to failure.

The novel invention of Ellershausen, on which his patent is based, is the mixing of crushed or pulverized ore with the molten metal, as it flows from the blast-furnace or cupola, thus forming masses of conglomerate, which are subsequently exposed to heat in a reverberatory furnace. The mingling of the two, was, in the first experiments, effected by pouring them simultaneously into an ingot-mould, while the mixture was stirred with a wooden pole. This method, however, is replaced by an ingenious arrangement of a large horizontal turning-table, around the periphery of which is a trough, divided by partitions into a series of compartments, into which the ore and the liquid metal are simultaneously discharged. The table being made to revolve, each compartment receives, in succession, a thin layer of mingled ore and metal, more or less intimately mixed, and the process is continued until the moulds are filled; when the consolidated masses, composed of successive layers, not over four-tenths of an inch in thickness, are removed, and are ready to be placed in a common puddling or other reverberatory furnace. Here, at a white heat, if the proper conditions have been observed, the conglomerate softens, without melting, the slag begins to flow out, and the iron is soon ready for the operations of squeezing and rolling.

It is claimed for this process for the production of malleable iron, that it requires much less time than puddling; the average time required for the treatment, in an ordinary single puddling furnace, of a charge of eight hundred pounds of the conglomerate, producing about six hundred pounds of muck-bar, not being over an hour and a quarter. The consumption of coal is reduced about one-half, and the ordinary labor of the puddler is done away with, the masses in the furnace requiring but little manipulation. The rapid wearing of the furnace-bottom, which, in puddling, causes such a loss of time, is also obviated. In addition to these advantages, which, in Pittsburg, it is claimed, effect a saving of eight or ten dollars a ton, it is found that the iron produced in this way is superior in quality to that obtained from the same pig metal by the process of puddling. This superiority is apparently explained by the fact, established by Dr. WUTH'S analysis, that the sulphur from the pig-metal is more completely eliminated by the Ellershausen process than by puddling. The analyses, with a summary of the report, will be found in the *Chemical News*, American edition, in the supplement for October, 1869; and with Dr. WUTH'S report, in full, in OSBORN'S *Metallurgy of Iron*, p. 565.

The Ellershausen process is now regularly worked at Pittsburgh, by Messrs. SHOENBERGER & Co., and in one or two other places in the United States; and in the opinion of some who are best qualified to judge, is destined to general adoption. Its introduction has been retarded by various causes, among which are the jealousies of puddlers, and in some cases, by partial failures, the probable causes of which have been pointed out in the preceding pages.

Numerous patent-claims, from that of JOHN WOOD, in 1761, down to the present time, have been based upon the use of granulated or pulverized cast iron for the production of steel or malleable iron. The iron is granulated by beating in large mortars, when heated nearly to its melting point, or by causing it to fall into water, through the air, or upon a rapidly-revolving disk, from which it is thrown off by centrifugal force. The grains of iron, more or less oxydized at the surface, are directed to be conveyed to a furnace, and there formed into lumps for the rolls or hammer; or else mixed with oxyd of iron, and exposed to heat in a furnace (or in close vessels) whereby a malleable iron, fit for the manufacture of steel, is obtained. See, among others, the specification of BOUSFIELD, in 1857, No. 3082, and that of MORGANS, in 1865, No. 806, of the British Patent Office. In so far as these propose to work in the open furnace, they differ from the old method of WOOD, and the Welsh process, already described, and approach to the conditions attained in the Ellershausen process. Excellent results have recently been obtained by Mr. HEWITT, at Ringwood, New Jersey, by mixing the granulated cast iron, with iron ore in grains, and exposing the mixture to heat on the hearth of a reverberatory; when decarbonization, and conversion to malleable iron takes place, as in Ellershausen's method, without fusion.

BETTENDORF has found a test so delicate that one part of arsenic in 1,000,000 parts of solution may be detected, and the presence of antimony does not affect it. To apply this test, the suspected liquid is mixed with hydrochloric acid until fumes are apparent. Chloride of tin is then added, and a basic precipitate, containing the greater part of the arsenic as a metal mixed with the oxide of tin, is thrown down.

MR. ROBERT BROWN, commander of the first Vancouver Exploring Expedition, in a paper "On the Coal-fields of the North Pacific Coast," concludes that though there are abundant supplies of tertiary coal on the North Pacific, the only beds fitted for steaming purposes are those of the British possessions. It is to be hoped that these will lead to the prosperity of British Columbia.

THE SUTRO TUNNEL is in 1,225 feet, and is now in regular casing, with a strong indication of soon striking a ledge.

MINING COMPANIES AND STOCK QUOTATIONS.

GOLD AND SILVER COMPANIES.	SITUATION OF MINE.	SECRETARY AND PLACE OF BUSINESS.	CAPITAL.	PAR VALUE.	OFF'R'D.	ASKED.
Alameda Silver		A. Queran, 108 Wall st.	$2,000,000	$10 00		
Ada Elmore	South Boise, Idaho					
American Flag	Nevada District, Col.	P. P. Fullerton, 71 B'way.	600,000	10 00	10	
Atlantic and Pacific	Humboldt Co., Nevada.					
Bates and Baxter	Colorado			50 00	15	
Benton	Colorado	W. F. Drake, 15 Broad.	500,000	5 00	05	
Briggs	Colorado	J. P. Davies, 19 Cliff.	1,000,000	100 00		
Black Hawk	Colorado	C.T.Whittington, 48 Broad.	2,500,000	100 00	28	30
Bobtail	Colorado	J. Stanton, Jr., 25 Nassau.	1,000,000			
Bullion Consolid'ed Gold	Colorado					
Burroughs Gold	Colorado					
Central Gold					27	28
Consolidated Gregory	Colorado				1 10	
Combination Silver	Nevada			100 00		1 50
Columbia Silver	Austin, Nevada	J. M. Brown, 155 B'way.	5,000,000			
Commercial Silver		J. E. Smith, 26 Pine	3,000,000			
Corydon	Gilpin Co., Colorado.	J. Samuels, 40 B'way.	500,000			
Downieville	Colorado		2,500,000	25 00		
Eagle Gold	Gold Dirt Dist., Col.	J. P. Davies, 19 Cliff.	300,000	1 00		
Empire Gold and Silver	BodieBluff,MonoCo.Cal	H. K. Gates, 70 B'way.	1,000,000			
Edgehill		A. Fullerton, 71 B'way.	10,000,000			
Esperanza Silver		Ezra Clark, Jr., 13 William.	400,000			
Fisk Gold		H. Johnson, 195 Fulton.	500,000			
Forest Queen		E. B. Beet, 62 B'way.	1,000,000			
Golconda Gold	Sherbrooke, C. E.	H. Adams, 71 Broadway.	2,000,000			
Gunnell Gold	Colorado	J. H. Rolston, 80 B'way.	1,000,000	50 00	15	
Gunnell Central	Colorado	C. B. Bostwick, 16 B'way.	3,000,000	10 00		
Gold Rock		R. M. Lockwood, 93 Wall.	400,000			
Grass Valley					39	42
International Silver		J. W. Brazier, 26 Pine	600,000			
Hope Gold	Colorado		5,000,000			
Holman			2,000,000	25 00		
Kipp & Buell	Colorado		300,000			
Knickerbocker Gold		J. H. Rolston, 80 B'way.	200,000	100 00		
La Crosse Gold	Nevada Dist., Col.	P. P. Fullerton, 71 B'way.	1,000,000		12	
Lander Hill T. & S	Nevada	M.L.Catherwood,74 B'way.	1,000,000			
Lewis Gold	Georgia		1,000,000			
Liberty Gold					02	04
Manhattan Silver	Nevada	M. L. Ogden	400,000			
Maraposa common	California	Jas. H. Ferdon, 34 Wall.	12,000,000		07	
Mariposa preferred	California	do. do.			15½	15¾
Montana Gold		G. De Cordova	400,000			
Montana M. L. & M. Co.	Montana	A. M. Hoyt, 22 William.	250,000			
Montrose	Clear Creek Co., Col.	W. W. Perkins, 71 B'way.	1,000,000			
New York Silver	Nevada	Thos. Sproull, 78 B'way.	1,500,000			
New York and Austin	Nevada	E. R. Siccomb, 70 Wall.	500,000			
New York and Owyhee	Owyhee Co., Idaho		1,000,000			
New York and Eldorado		G. H. Munroe, 10 Wall.	2,000,000		20	
N. Y. & Montana M. & D.	Montana	F. A. Chapman, 20 Nassau.	1,250,000			
N. Y. & Silver Peach	Nevada	R. C. Root, 74 B'way.	2,000,000			
N. Y. & Utah P. & M		W. H. Mailler, 108 Wall.				
Nye						
Ophir Gold	Comstock Lode, Nev.	L. C. Warner, 70 B'way.	625,000			
Owyhee Gold		W. H. Smith, 43 Ex. Place.	1,700,000			
Pahranagat Central	Nevada	J. E. Smith, 25 Pine	6,000,000			
Quartz Hill Gold		F. Bernard	2,500,000		25	
Reese River Consol'd	Nevada	W. B. Ogden	6,000,000			
Rocky Mountain	Colorado	S. M. Pond, 70 B'way.	500,000	10 00		
Rollins Gold		Thos. Bond, 132 B'way.	600,000			
Sensenderfer	Colorado	H. A. Shewill, 19 Broad.	1,000,000			
Silver Bend		F. W. Macy, 20 Nassau.	1,500,000			
Silver Mt. Silver		H. A. Moen, 71 B'way.	1,000,000			
Silver Peak & R. M.	Nevada	W. B. Ogden, 52 Wall.	5,000,000			
Smith & Parmelee	Colorado	W. H. Hollister, 6 Broad.	2,500,000	20 00	1 00	1 10
Social & Steptoe Con		T. H. O'Connor, 24 Nassau.	450,000			
Standard Gold		C. B. Bostwick, 169 B'way.	500,000			
Symonds Forks						75
Twin River Silver	Nevada	J. F. R. Hadden, 20 Nassau.	800,000	100 00		
Texas Gold	Colorado		500,000	10 00		
Union Gold	Colorado	F. A. Potts, 110 B'way.	1,200,000			
Wash. Mill & Silver	Nevada	W. W. Perkins, 71 B'way.	300,000			
Wauba Yuma	Arizona	J. W. Silsby, 36 Pine.	6,000,000			

COAL AND IRON COMPANIES.	SITUATION OF MINE.	SECRETARY AND PLACE OF BUSINESS.	CAPITAL.	PAR VALUE.	OFF'R'D.	ASKED.
American Coal Co		M. A. Myers, 119 B'way.	$1,500,000	$25 00		
Ashburton Coal Co		J. T. Rollins, 41 Pine.	2,500,000			
Block House Coal		D. B. Keeler, Jr., 43 Pine.	1,000,000			
Brewster Iron		H. Robison, 165 B'way.	150,000			
Broad Top Coal & Iron Co	Pennsylvania	B. Love	2,000,000			
Cameron Coal Co		J. A. Simpson, 40 B'way.	2,500,000			
Carbon Hill Coal Co		J. Silsby, 36 Pine.	1,000,000			
Central Coal		F. P. White, 111 B'way.	2,000,000	100 00		
Clifton Iron Co		P. H. Riordan, 34 Pine.	1,250,000			
Columbia Iron		F. D. Webb, 77 Cedar.	1,000,000			
Consolidation Coal	Maryland	J. S. Mackie, 71 B'way.	5,000,000			
Crawford Coal		E. Clapp, Prest, 137 B'way.	1,000,000			
Cumberland C. & I. Co		E. Kisean, 90 B'way	5,000,000			
Derby Coal Co		W. S. Davison, 11 Broad.				
Dover Coal and Iron Co		L. Chase, 88 Wall				
Del. & Hudson Canal Co		R. H. Nodyne, 7 Nassau.	15,000,000	100 00		
Ebervale Coal		G.L Stout, Treas.,111 Br'y.	500,000			
Fall River Bituminous		D. T. Blauvelt, 43 Pine.	1,000,000			
Farrar Coal		C. H. Jones, 43 Pine.	250,000			
Fisher Iron Co		M. Ellis, 19 William.	100,000			
Hamp're & Balt Coal		S. M. Pond, 70 B'way.	500,000			
Iron Cliffs Co		C. J. Canda, 52 Wall.	1,000,000			
Jackson Iron		G. P. Loyd, 119 B'way.	300,000			
Kemble Coal & I. Co		R. A. Wight, 26 Ex. Place.	300,000			
Keokuk Coal		J. F. Franklin, 112 B'way.	100,000			
Lackawanna I. & C	Pennsylvania	E. C. Lynde, 52 Wall.	1,200,000			
Lewis Run C. & I. Co		C. A. Sanborn, 80 B'way.	750,000			
Lykens Val. Coal Co		F. A. Platt, 13 William.	800,000			
McKean Co. Bit. Coal Co		J. H. Rolston, 80 B'way.	1,500,000			
Lehigh & Susquehanna		E. W. Cark, Philadelphia,Pa.			1 05	
Mahanoy			400,000	100 00		
McNeal C. & I. Co		C. C. Godwin, 71 B'way.	500,000			
Mount Riga Iron		G. M. Newton, 42 Cedar.	300,000			
New Boston Coal		C. H. Ogden, 55 B'way.	2,000,000			
N. Y. Con. C. & I. Co		A. T. Levine, 16 Wall.				
N. Y. & Lehigh Coal		T. Simpson, 111 B'way.	150,000			
Pacific Coal Co		G. Wrighton, 34 Wall.				
Peekskill Iron Co		W. Murdock, 7 Nassau.				
Pennsylvania Coal Co		E. H. Mead, 111 B'way.	3,200,000	50 00		
Richmond Iron Co		C. H. Smith, 165 B'way.	1,000,000			
Scotia Coal Co		L. S. Soper, 42 B'way.	2,500,000			
Spring Mt. Coal		J. Runyon, 111 B'way.	1,250,000			
Springfield & D'p Run C.		E. D. Webb, 77 Cedar.	600,000			
Stout Coal Co		G. S. Comstock, 111 B'way.	500,000			
Susquehanna & Wyoming		E. Potter, 40 B'way.	1,000,000			
Tannerdale Coal		I. T. Ludlaw, 71 B'way.	250,000			
Wash. Mutual Coal		M. C. Baker, 117 B'way.	420,000			
West Point Iron Co		R. C. Brock, 110 B'way.	500,000			
Wilkesbarre C. & I. Co		W. H. Tillinghast, 80 Br'y.	3,400,000			
Wyoming Val. Coal Co		E. Potter, 40 B'way	1,000,000			

COPPER AND LEAD COMPANIES.	SITUATION OF MINE.	SECRETARY AND PLACE OF BUSINESS.	CAPITAL.	PAR VALUE.	OFF'R'D.	ASKED
Anita Copper	California	J. A. Ferguson, 8 Wall.				
Corinth Copper	Corinth, Vermont	S. H. Howard, 191 B'way.	$500,000	25 00		
Davidson Copper						
Eagle Harbor Copper	Michigan	W. H. Smith, 43 Ex. Place.	500,000	25 00		
Evergreen Bluff Copper	Michigan	F. W. Caper, 44 Ex. Place.	500,000	25 00		
Globe Copper		R. K. Rickard, 19 Nassau.	200,000			
Grand Portage Copper Co		A. S. Kellogg, 22 Pine.	500,000			
Guymard Lead		Samuel Vernor, 38 Pine.				
Hilton Copper		W. H. Smith, 43 Ex. Place.	500,000			
Hope Copper		J. W. Davis, 19 Nassau.	500,000			
Hudson River Copper	New York	T. Clarkson, 22 William.	1,500,000			
Indiana Copper Co		J. M. Mills, 25 Nassau.	500,000			
Isle Royale Copper	Michigan	F. W. Caper, 44 Ex. Place.	1,000,000			
Keweenaw Copper	Michigan	F. W. Caper, 44 Ex. Place.	500,000			
Lake Superi'r Silver Lead	Michigan	A. S. Kellogg, 22 Pine.	1,000,000			
Omiga Copper	Michigan	S. Cooper, 7 Pine.	500,000			
Ridge Copper	Michigan	J. L. Gardiner, Jr., 43 Ex. P.	500,000			
Rockland Copper	Michigan	A. Fullerton, 71 B'way	500,000			
St. Joseph Lead	Michigan	J. W. Jones, 6 Broad st,	1,000,000			
St. Marguret Copper		E. P. Sutton, 43 Pine.	250,000			
Schoolcraft Copper		R. Walsh, 22 William.	500,000			
Superior Copper	Michigan	A. Fullerton, 71 B'way.	500,000			
Union Copper		A. S. Kellogg, 22 Pine.	500,000			
Vermont Copper	Vermont	J. C. Fly, 191 B'way.	500,000			
Wallkill Lead, asst		S. M. Pond, 70 B'way.			02	

MISCELLANEOUS.	SITUATION MINE.	SECRETARY AND PLACE OF BUSINESS.	CAPITAL.	PAR VALUE.	OFF'R'D.	ASKED.
American Zinc Co		W. E. Lawton, 19 Cliff.	$1,000,000			
Bigelow Blue Stone Co		H. Bogardus, 14 Pine.				
Quicksilver					7½	9
Quicksilver Pref					12	16
Manhattan Marble		H. K. Gates, 70 B'way.	300,000			
N. Jersey Zinc Co	New Jersey	A. H. Farlin, 61 Maiden L'e.	1,500,000			

Welding Copper.

MR. PHILIP RUST, Bavarian Inspector of Salt Works, writes to *Dingler's Polytechnic Journal* as follows: The great obstacle heretofore experienced in welding copper has been that the oxide formed is not fusible. Now, if any fusible compound of this oxide could be found, it would render such a weld possible. We find in mineralogy two copper salts of phosphoric acid, namely, libethenite and pseudo-malachite, each of which melts readily before the blow-pipe. It was therefore natural to suppose that a salt which would yield the same at a red heat, would make the weld easy by removing the oxide as a fusible slag.

The first trial was made with microcosmic salt, phosphate of soda and ammonia, and succeeded perfectly. As this salt was dear, it was found advisable to use a mixture of one part of phosphate of soda and two parts of boracic acid, which answered the same purpose as the original compound, with the exception that the slag formed was not quite as fusible as before. This welding powder should be strewn on the surface of the copper at a red heat; the pieces should then be heated up to a full cherry red, or yellow heat, and brought immediately under the hammer, when they may be as readily welded as iron itself. For instance, it is possible to weld together a small rod of copper which has been broken; the ends should be bevelled, laid on one another, seized by a pair of tongs, and placed, together with the latter, in the fire and heated; the welding powder should then be strewn on the ends, which, after a further heating, may be welded so soundly as to bend and stretch as if they had never been broken. It is necessary to carefully observe two things in the course of operation. First, the greatest care must be taken that no charcoal or other solid carbon comes into contact with the points to be welded, as otherwise phosphide of copper would be formed, which would cover the surface of the copper and effectually prevent a weld. In this case it is only by careful treatment in an oxidizing fire and a plentiful application of the welding powder that the copper can again be welded. It is therefore advisable to heat the copper in a flame, as, for instance, a gas-flame. Second: as copper is a much softer metal than iron, it is much softer at the required heat than the latter at its welding heat, and the parts welded cannot offer any great resistance to the blows of the hammer. They must, therefore, be so shaped as to be enabled to resist such blows as well as may be, and it is also well to use a wooden hammer, which does not exercise so great a force on account of its lightness. Mr. RUST states that, as long ago as 1854, he welded strips of copper plates together and drew them into a rod; he also made a chain, the links of which had been made of pretty thick wire and welded.

Altering the Prussian Needle-Gun.

THE alteration of the Prussian needle-gun has been sanctioned by the King, in consequence of which the two or three millions of rifles in the possession of the Government will be remodelled. The improvements introduced aim at simplifying the loading and increasing the force and range of the ball. For this purpose the caoutchouc-ring of the Chassepot has been adopted, which, helping to close the breach by spontaneous action, renders it unnecessary to press the valve down so tightly. In addition to this, the weight of the ball has been reduced from 31 to 21 grammes, which, with the charge remaining at 4.9 grammes, as formerly, considerably augments the propelling force. To fit the reduced ball for the old barrel, the *zundspiegel* has been proportionately enlarged, a proceeding, the practicability of which was proved by a similar alteration, adopted some time ago, and further attested by a year's experiments with the weapon in its present latest form. On the needle-gun being first taken into favor in 1841, it had a ball of 15.43 millimetres, but the heaviness and consequent want of speed observable in the missile, caused it to be soon reduced to 13.6 millimetres, which size has now been further diminished to 12 millimetres. The total weight of the new cartridge is 22 grammes, instead of 40 grammes, as heretofore, so that the soldier will henceforth carry 95 instead of 75 cartridges, without experiencing an additional burden. Besides this, the needle is now made to move in a narrow hole, into which it fits exactly, instead of the wider one of the old gun, and a piece of oiled paper is placed at the bottom of the cartridge, to clean the needle after each discharge, and serve some other purposes of minor importance. By these improvements it is hoped to raise the Prussian needle-gun, which has the glory of being the first breech-loading rifle ever introduced into an army, to the latest requirements, and make it practically a match for all its manifold rivals. Though among these latter there are some with a ball of only 11, and even 10 millimetres, it is contended that the advantage derived from this small calibre is of no practical use in the field, and that the Prussian rifle, in its present form, fires quite as rapidly and as far as the purposes of warfare require. That the alterations resolved upon are not very costly, is owing to the ingenious construction of the *zundspiegel*, which admits of a small ball being shot out of a comparatively wide barrel.—*Van Nostrand's Engineering Mag.*

MISCELLANEOUS.

A NEW 30 HORSE POWER STEAM ENGINE fitted with "Metaline." NO OIL OR GREASE required, for sale by
FRANKLIN E. BRADSHAW,
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New York Fire Brick

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PROPOSALS.

DEPARTMENT OF PUBLIC WORKS, 237 BROADWAY.—TO CONTRACTORS.—Proposals inclosed in a sealed envelope, indorsed with the name of the bidder written thereon (also the number of the work as in the advertisement), will be received at this office until Monday, July 11, 1870, at 11 o'clock A. M., for the following work:

No. 1. For paving Christie street, from Division street to Grand street, with stone blocks.

No. 2. For paving Eighty-sixth street, from Third avenue to East River, with stone blocks.

No. 3 For paving Elizabeth street, from Grand street to Bleecker street, with stone blocks.

No. 4. For paving Seventeenth street, from First avenue to East River, with stoneblocks.

No. 5 For paving Sixty-fourth street, from Third avenue to Fifth avenue, with stone blocks.

No. 6. For paving Forty-second street, from Tenth avenue to Hudson River, with stone blocks.

No. 7. For paving Forty-third street from Eighth avenue to Hudson River, with stone blocks.

No. 8. For sewer in First avenue, between Fifty-fifth street and Fifty-sixth street.

No. 9. For sewer outlet in Eighty-ninth street, between East River and Second avenue, with branches in Avenue A, First avenue, and Eighty-seventh and Eighty-eighth street.

No. 10. For sewer in Water street, between Moore street and Coenties slip, and Front street, between Montgomery street and Gouverneur street.

No. 11. For sewer in Avenue A, between Seventy-fourth street and Seventy-ninth street, from branches in Seventy-fifth street, Seventy-sixth street, Seventy-seventh street, and seventy eighth street.

No. 12. For sewer in First avenue, between Houston street and Third street; Avenue A, between Second street and Third street, and Avenue D, between Third street and Fourth street.

No. 13. For curbing, guttering, flagging, &c., Sixty-fifth street, from Third to Fifth avenue.

No. 14. For curbing, guttering, flagging, &c., South street, from Jackson street to Corlears street, and Corlears street, from South street to Water street.

No. 15. For curbing, guttering, flagging, &c., First avenue, from Thirty-fourth to Thirty-sixth street (east side).

Blank forms of proposals, together with the specifications and agreements, can be obtained on application at this office.

WILLIAM M. TWEED,
Commissioner.

New York, June 30, 1870.

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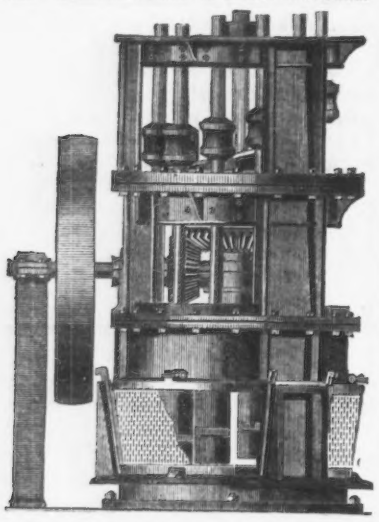

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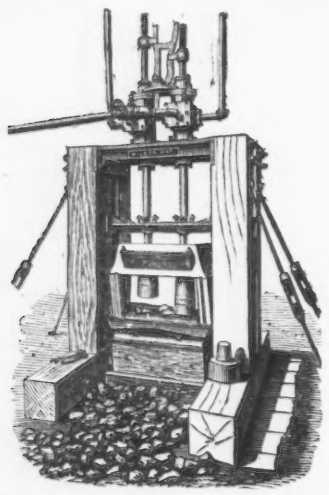

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The *MECHANICAL COMBINATIONS* are extremely simple, the machines therefore correspondingly durable. A continuous self-delivery of ore on one side and tailings on the other is effected, hence very little attention is required except keeping the hopper supplied with ore. The power of one man is sufficient to operate a machine that will concentrate one ton per hour.

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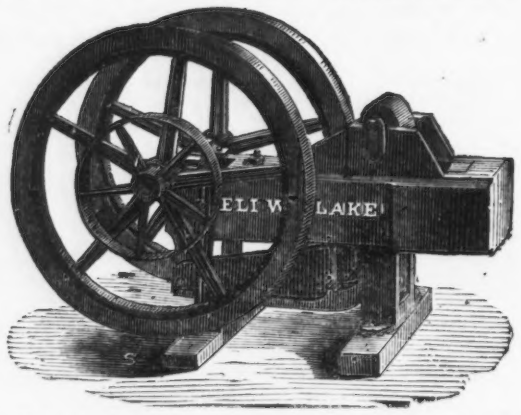

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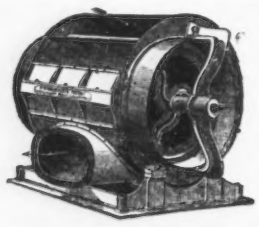

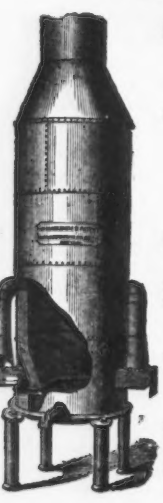

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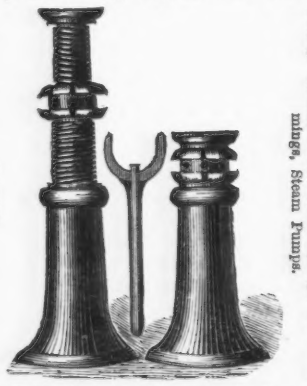

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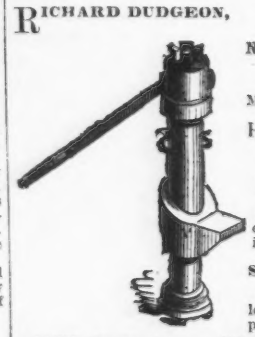

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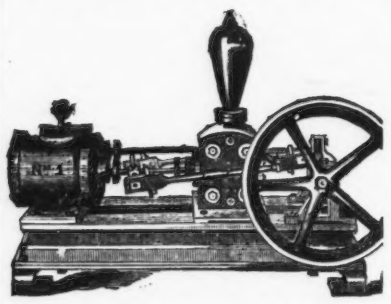

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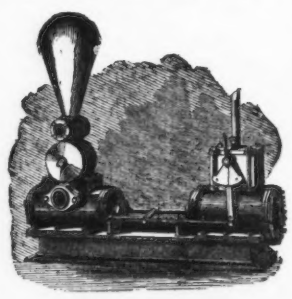

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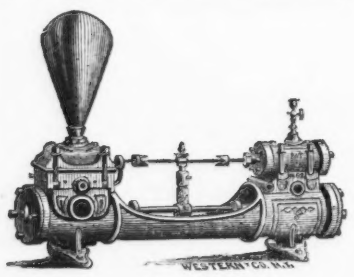

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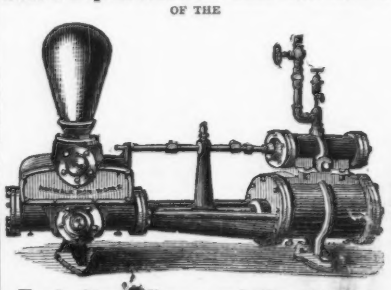

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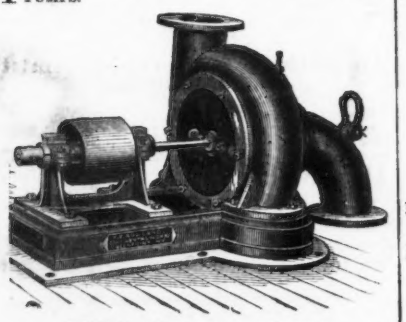

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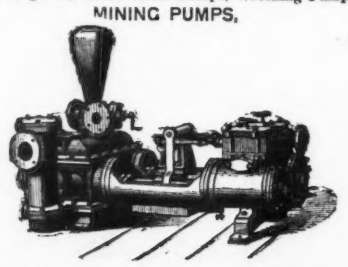

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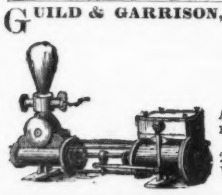

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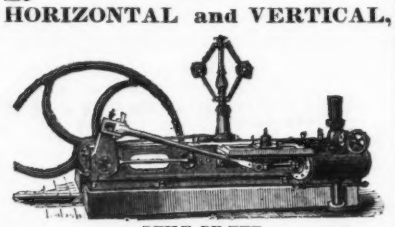

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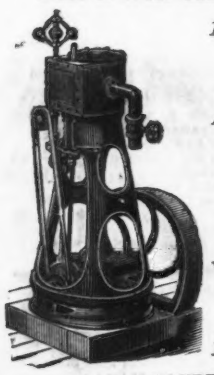

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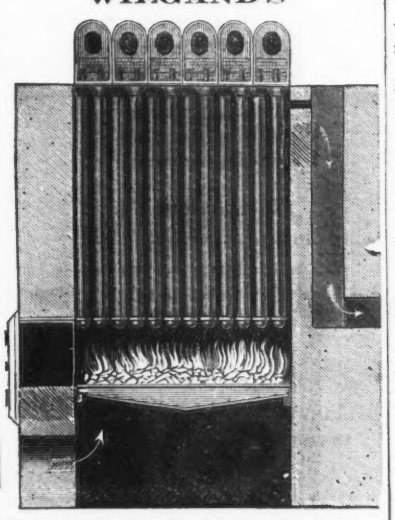

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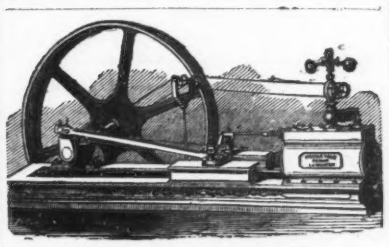

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" Splitting of (plans)
" One current of (plans)
" One current of, and how to adopt separate currents (plan)
" Dividing of, but not into "separate and and distinct" current (plans)
" Crossings (see H on plans)
" Weight of in shafts
" How to find the weight of
" Table of pressure in shafts
" Expansion of
" Its velocity and force
" Rush of, into each division
" Quantity produced by natural ventilation
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" Splitting, why the workmen object to Mr. Hopton adopting the mode
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Barometers, Showing the time of an outlet of gas in mines (engraving)
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Coal, several ways of working it out, and why man methods of working it out are adopted
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" How fixed in mine surveying
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" (Carburetted hydrogen) do.
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" The elasticity of
" The weight of
" The nature and quality of
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" Why some mines generate a mixture of
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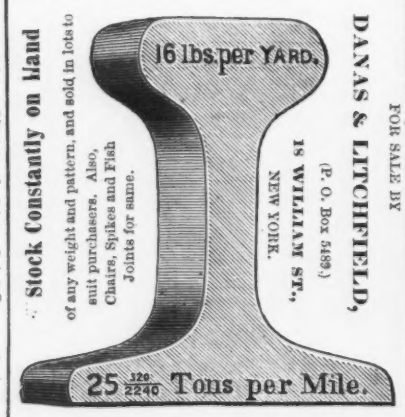
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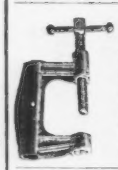

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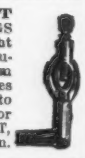

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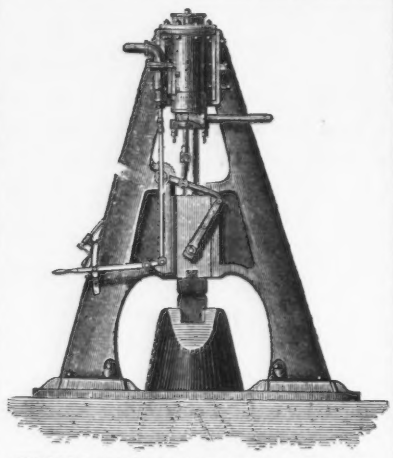

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